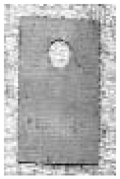
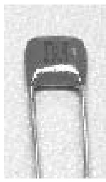
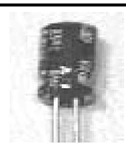
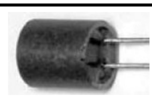
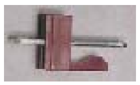
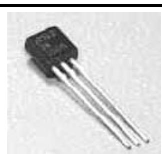
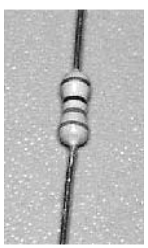
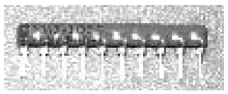
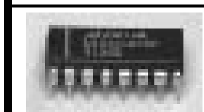
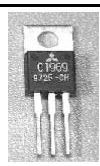
Appendix A	K2 Packing Box Parts List				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	PCB3	RF	Printed Circuit Board, RF	E100086	1
	B1	left side	Chassis piece, painted	E100076L	1
	B2	right side	Chassis piece, painted	E100076R	1
	B3	front panel	Chassis piece, painted/silk-screened	E100072SS	1
	B4	rear panel / heatsink	Chassis piece, painted/silk-screened	E100075SS	1
	B5	top cover	Chassis piece, painted/silk-screened	E100073SS	1
	B6	bottom cover	Chassis piece, painted	E100074	1
	Bag, Wire Pack		Wire, coax, heatshrink tubing	E850005	1
	Bag, Front Panel Parts		Front Panel board parts	E850003	1
	Bag, RF Parts		RF board parts	E850001A & B	1
	Bag, Control Parts		Control board parts	E850002	1
	Bag, Misc. Parts		Hardware and Misc. parts	E850004	1
	K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16, K17	Latching Relay, 5V	In plastic tube; 10-pin DIP	E640001	17
	Manual	K2 Manual		E740001	1
	SP1	Speaker	4-ohm, 3-watt, high-sensitivity speaker	E980007	1
	KN1	Knob, 1.6" diam	Main Tuning Knob, weighted, 6mm shaft	E980013	1
	KN2, KN3, KN4, KN5, KN6	Knob, 0.5" diam	Small Control Knobs, 6mm shaft	E980016	5
	Docs	Toroid Order Form		E740038	1

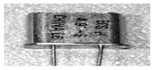
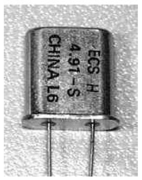
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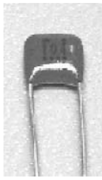
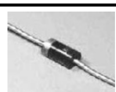
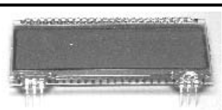
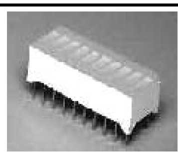
Appendix A	**Items inside back of manual**	E850011			
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	Misc	Acrylic display bezel	Covers LCD and LED bargraph (FRONT PANEL)	E100080	1
	HW	Thermal insulator, TO220	Adhesive Thermal Insulators for Q6, Q7, Q8 (RF BOARD)	E700002	3
	S/N	Serial Number Label		E980010	1
	Misc	Green filter w/ adhesive	1.15” x 0.95” with adhesive strips. (FRONT PANEL)	E980011	1

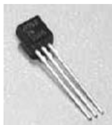
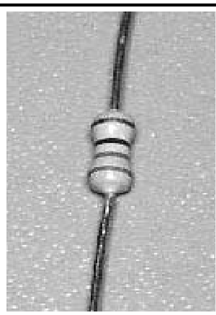
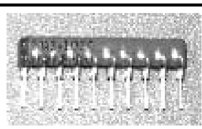
Appendix A	K2 Control Board Parts List (p/n E850002)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	C2, C20, C34, C43	.001	Monolithic Cap, "102"	E530001	4
	C12, C24, C36	.0027	Monolithic Cap, "272"	E530055	3
	C3,C5,C9-C11,C17,C18, C23, C31,C35,C37,C39-C41,C46	.01	Monolithic Cap, "103"	E530009	15
	C27	.022	Monolithic Cap, "223"	E530056	1
	C6, C14, C16, C19, C30	.047	Monolithic Cap, "473"	E530025	5
	C25, C26, C42	0.1	Monolithic Cap, "104"	E530011	3
	C4	0.47uF	Monolithic Cap, "474"	E530057	1
 	C21	33	p, (p g 9)	E530064	1
	C8	39	NPO disc cap, "39" or "390"	E530036	1
	C7	330	NPO disc cap, "331"	E530043	1
	C38	680	NPO disc cap, "681"	E530053	1
	C1, C33	2.2µF	Electrolytic cap	E530023	2
	C13, C32, C45	22µF	Electrolytic cap	E530012	3
	C15	100µF	Electrolytic cap	E530061	1
	C28, C29	220µF	Electrolytic cap	E530062	2
	C22	var, 8-50pF	Ceramic trim cap (Green paint on screw with RED Marking on side; or no markings at all.)	E540000	1
	D1, D2	1N4148	Silicon switching diode, small glass body	E560002	2
	L1	82 mH inductor, 5%	Shielded, cylindrical, dark gray	E690015	1

Appendix A	**K2 Control Board Parts List (p/n E850002)**				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	P1	6P male, RA	Right Angle 6 pin connector	E620041	1
	P2	18x2 male, RA	Right Angle 18 x 2 pin connector	E620043	1
	P3	10x2 male, RA	Right Angle 10 x 2 pin connector	E620042	1
	P4	5x2 pin male	5 x 2 pin connector; for Aux I/O	E620040	1
	P5, P6	2 pin male	Includes locking ramp; for Volt Meter, Freq. Counter Inputs	E620024	2
	P7	3p male	For voltmeter source selection	E620007	1
	Q1, Q2	2N3906	TO-92	E580000	2
	Q3, Q4, Q5	2N7000	TO-92	E580002	3
	Q6, Q7	J310	TO-92	E580012	2
	Q8, Q11, Q12	PN2222A	TO-92	E580001	3
	Q9,Q10	MPS5179	TO-92	E580014	2
	R8	100, 1%	(BLUE)	E500059T	1
	R7	1.78k, 1%	(BLUE)	E500026T	1
	R10	196K, 1%	(BLUE)	E500051T	1
	R9	806K, 1%	(BLUE)	E500052T	1
	R18, R19	0 ohm	Use short wire jumpers on back (see text)	n/a	2
	R20	2.7 ohm, 5%	(TAN)	E500055T	1
	R16	10, 5%	(TAN)	E500054T	1
	R6	100, 5%	(TAN)	E500010T	1
	R12	820, 5%	(TAN)	E500001T	1
	R4	5.6K, 5%	(TAN)	E500007T	1
	R3	10K, 5%	(TAN)	E500015T	1
	R5	33K, 5%	(TAN)	E500057T	1
	R11	47K, 5%	(TAN)	E500067T	1
	R22	82K, 5%	(TAN)	E500119T	1
	R21	270K, 5%	(TAN)	E500101T	1
	R2, R17	3.3M, 5%	(TAN)	E500021T	2

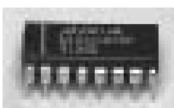
Appendix A	K2 Control Board Parts List (p/n E850002)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	R1	50K Trimmer	AGC Threshold	E520011	1
	RP5	470,5R ISO "10A3-471G"	SIP resistor pack, 10 pins; ALT: "770103471"	E510015	1
	RP1	3.9K,5R ISO "770103392"	SIP resistor pack, 10 pins; ALT: "10A3392G"	E510014	1
	RP6	5.1K,5R ISO "770103512"	Sip resistor pack, 10 pins; ALT: "10A3512G"	E510013	1
	RP7	33K,4R ISO "8A3-333G"	SIP resistor pack, 8 pins; ALT: "77083333"	E510016	1
	RP3	47K,5R ISO "10A3-473G"	SIP resistor pack, 10 pins; ALT: 770103473"	E510007	1
	RP2, RP4	82K,4R ISO "77083823"	SIP resistor pack, 8 pins; ALT: "08A3823G"	E510011	2
	U1	SA602AN	AGC Mixer (SA612 Alt.), 8 pins	E600006	1
	U2	LM833N	Dual Op Amp, 8 pins	E600012	1
	U3	LMC6482AIN	Dual Op Amp, 8 pins	E600011	1
	U9	LM380N-8	Audio Amplifier, 8 pins	E600019	1
	U7	25LC320	EEPROM; 4K x 8, 8 pins	E600009	1
	U10	LMC660	Quad Op Amp, 14 pins	E600025	1
	U8	MAX534	Quad, 8-bit DAC, 16 pins	E600031	1
	U4	LM2930T-8	8 Volt regulator, TO-220 Pkg.	E600018	1
	U5	78M05 Alt: 7805, 7805T, L7805	5 Volt regulator, TO-220 Pkg.	E600024	1
	U6	PIC18C452	MCU, Programmed, 40 pins	E610002	1

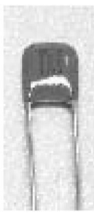
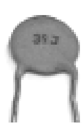
Appendix A	K2 Control Board Parts List (p/n E850002)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	X1	5.068Mhz	Crystal, HC49 (may be standard or low-profile)	E660009	1
	X2	4.000MHz	Crystal, HC49 (standard)	E660006	1
	MISC	40 pin socket	socket for MCU	E620017	1
	MISC	2-pin shorting jumper	For use with P7 (voltage source select)	E620055	1
	PCB1	Control	Printed Circuit Board, Control	E100084	1

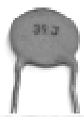
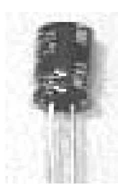
Appendix A	K2 Front Panel Board Parts List (p/n E850003)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	C1, C3	.047	Monolithic, "473"	E530025	2
	C2, C9	.01	Monolithic, "103"	E530009	2
	D2, D3	LCD Backlight Assy	LED Backlights mounted in Diffuser	E570004	1
	D4, D5, D6	1N5817	(BLACK)	E560008	3
	DS1	VIM-838-DP	4-character, 7-Segment multiplexed LCD	E570003	1
	DS2	10LED array	Hi-eff. Green LED bargraph	E570005	1
	HW	Felt Washer, 1" OD	Mounts under main tuning knob	E700033	1
	HW	Spacer Set (made from PCB stock)	(4) 0.75" spacers for Backlight LEDs; (1) spacing tool for push button switches	E100079	1
	J2	8p male	Mic Jack; Male; PCB Mount, Round	E620034	1

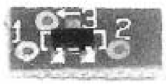
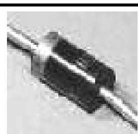
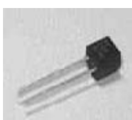
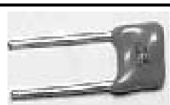
Appendix A	K2 Front Panel Board Parts List (p/n E850003)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	Misc	Keycap, rect, black	Black keycaps for Push Buttons (BLACK)	E980000	13
	Misc	Keycap, rect, gray	Band up/down keycap; S1, S3 (GRAY)	E980027	2
	Misc	Keycap, square, black	Rate / Lock Keycap; S7, (BLACK, Square)	E980009	1
	Q1, Q2	PN2222A	Plastic Body, TO-92	E580001	2
	R1, R2, R4, R5	5K potentiometer, **linear taper**	"B5K"; Keyer Speed, Power Out, I.F. Gain, RIT/XIT Offset	E520004	4
	R3	5K potentiometer, **audio taper**	"A5K"; Audio Gain Control	E520003	1
	R10	33	1/4W, 5% resistor. (TAN Color)	E500036T	1
	R12	120	1/4W, 5% resistor. (TAN Color)	E500022T	1
	R9	220	1/4W, 5% resistor. (TAN Color)	E500002T	1
	R11	470	1/4W, 5% resistor. (TAN Color)	E500003T	1
	R6, R7	4.7K	1/4W, 5% resistor. (TAN Color)	E500047T	2
	R15	10K	1/4W, 5% resistor. (TAN Color)	E500015T	1
	R16	15K	1/4W, 5% resistor. (TAN Color)	E500060T	1[1]
	R14	100K	1/4W, 5% resistor. (TAN Color)	E500006T	1
	RB1, RB2	Rubber bumper; .040 or .047 thick, x .312" square	For top corners of FP PCB	E980017	2
	RP2	120Ω SIP, "770101121"	SIP 10pin resistor pack; ALT: "10A1121G"	E510012	1
	RP1	100K SIP, "10A1-104G"	SIP 10pin resistor pack; ALT: "770101104"	E510010	1

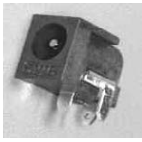
[1] Note: A second (extra) 15K, 1/4W resistor in included in case it is needed to set the AGC level correctly as described on page 48 of the assembly instructions.

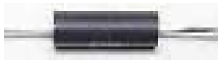
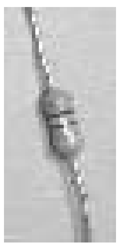
Appendix A	**K2 Front Panel Board Parts List (p/n E850003)**				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16	switch, push button	Front Panel push button switches	E640005	16
	Misc	40 pin socket	for LCD driver chip, U1	E620017	1
	U1	PCF8566PN	LCD Driver chip, 40 pin	E600027	1
	U2	74HC165N	8-bit parallel-in, serial-out shift register, 16 pin	E600028	1
	U3, U4	TPIC6B595N Alt: 6B595KA	8-bit serial-in, parallel-out shift register, 20 pin	E600032	2
	Z1	Shaft Encoder	100-count incremental encoder w/straight pins; VFO main tuning control	E640003	1
	PCB2	front panel	Printed Circuit Board, Front Panel	E100083	1

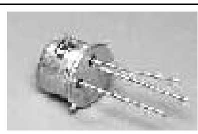
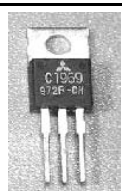
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	C1, C2, C9, C17, C26, C27, C37, C38, C39, C49, C57, C64, C77, C79, C80, C81, C82, C89, C91, C100, C140, C167, C195, C204, C207, C208, C216, C223	.001	Monolithic Cap, "102"	E530001	28
	C52, C53, C54, C55, C58, C61, C62, C63, C87, C95, C107, C108, C109, C110, C113, C114, C115, C118, C119, C120, C121, C129, C135, C141, C142, C143, C145, C146 C155, C158, C159, C160, C161, C163, C164, C165, C168, C172, C175, C181, C183, C184, C186	.01	Monolithic Cap, "103"	E530009	43
	C92, C177	.022	Monolithic, "223"	E530056	2
	C90, C94, C117, C138, C156, C157, C162, C166, C170, C196, C224	.047	Monolithic, "473"	E530025	11
	C59, C65, C67, C86, C124, C130, C131, C133, C139, C151, C176, C178, C185	0.1	Monolithic, "104"	E530011	13
	C45	1 pF	NPO, "1", black top	E530068	1
	C33	2.2 pf (alt: 2 pF)	NPO, "2R2" or "2"	E530047	1
	C22	p (pF)	NPO, "2R7", "3", "3.3", or "3R3"	E530065	1
	C6	4.7pf (alternate: 5 pF)	NPO, "4.7"	E530048	1
	C68, C211	10	NPO, "10" or "100" (see page 9)	E530006	2
	C28, C29, C219	12	NPO, "12" or "120"	E530058	3
	C74	20	NPO, "20" or "200"	E530059	1
	C198	27	NPO, "27" or "271"	E530060	1
	C43, C47, C116, C213	33	NPO, "33" or "330"	E530064	4

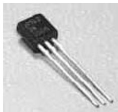
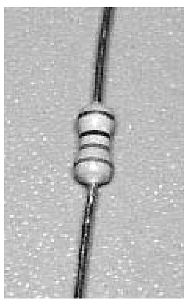
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	C221	39	NPO, "39" or "390"	E530036	1
	C20, C24, C73, C203	47	NPO, "47" or "470"	E530014	4
	C31, C35, C122, C228	56	NPO, "56" or "560"	E530015	4
	C88, C153, C104, C214	68	NPO, "68" or "680"	E530007	4
	C71, C174, C210	82	NPO, "82" or "820"	E530038	3
	C5, C7, C144, C154, C179, C197, C222	100	NPO, "101"	E530016	7
	C84, C85, C202	120	NPO, "121"	E530041	3
	C200, C212, C218	150	NPO, "151"; markings on rear side may include: "041 RKF"	E530049	3
	C182	180	NPO, "181"	E530008	1
	C173, C199, C201, C220, C229	220	NPO, "221"	E530042	5
	C72	270	NPO, "271"	E530050	1
	C19,C25,C42,C48,C150,C227	330	NPO, "331"	E530043	6
	C169, C225	390	NPO, "391"	E530051	2
	C30, C36	470	NPO, "471"	E530004	2
	C12, C15	560	NPO, "561"	E530052	2
	C127, C128, C226	680	NPO, "681"	E530053	3
	C4, C8	820	NPO, "821" (Do not confuse with 150pf)	E530066	2
	C190, C192	1200	NPO, "122"	E530005	2
	C11, C16, C191	1800	NPO, "182"	E530035	3
	C96	1uF	Monolithic Cap (Thick) "105"	E530037	1
	C105, C106, C111	2.2uF	Electrolytic	E530023	3
	C93	10uF	Electrolytic	E530045	1
	C125	22uF	Electrolytic	E530012	1
	C126	47uF	Electrolytic	E530063	1
	C60, C137	100uF	Electrolytic	E530061	2
	C103	220uF	Electrolytic	E530062	1

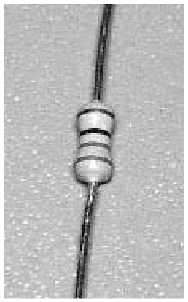
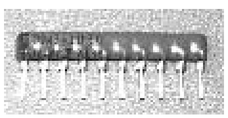
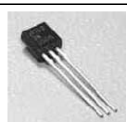
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	C44, C46, C32, C34	var,5-30pF	ceramic trimmer (see below to tell from 50 pF)	E540001	4
	C21, C23	var,8-50pF	ceramic trimmer (red mark or bagged separately)	E540000	2
	D9	1N5711	orange glass body	E560004	1
	D1, D2, D3, D4, D5, D6, D7	1N4007	large black body, silver band	E560001	7
	D8, D11, D13, D18, D40, D41	1N4148	clear or blue glass body	E560002	6
	D36	SMT1B	pin diode supplied on pc daughterboard	E120014	1
	D10	95SQ015	ultra-low-drop shottky diode, 9A, very large black body	E560009	1
	D12	SB530 (alternate: 1N5821)	shottky diode, 5A, very large black body	E560003	1
	D16, D23, D24, D25, D26, D39 (also D19-D20--see description)	MV209	TO-92, 2 leads D19-D20 supplied with K60XV option	E560006	6
	D17, D21, D22, D29, D30, D31, D32, D33, D34, D37, D38	1SV149	TO-92, 2 leads	E560005	11
	F1	RGE300	Resettable fuse; (YELLOW) "G300" Looks like a larger monolithic cap.	E980018	1
	J8	10x2,female socket	10 x 2 female socket	E620038	1
	J7	18x2,female socket	18 x 2 female socket	E620039	1

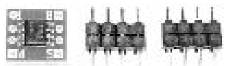
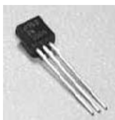
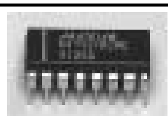
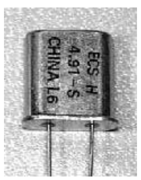
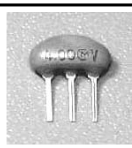
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	J3	2.1mm jack	2.1 mm DC barrel connector	E620026	1
	J6	6p,female socket	6 x 1 female socket	E620037	1
	J4	BNC	Antenna connector	E620020	1
	J1	SJ-373	Keyer Jack, Threaded, Stereo, Vertical orientation	E620027	1
	J2	Stereo+iso sw.	Headphone jack. Horizontal Orientation	E620028	1
	L10, L11, L12, L13	Variable Ind, 1µh	**TOKO**, 15/17m BPF, 10/12m BPF. Red Line and small adjustment slot	E690002	4
	L30, L1, L2, L3, L4, L8, L9, L34	Variable Ind, 4.7µH "T1005Z"	**TOKO**, VCO, IF, 40m BPF, 80/160m BPF, 20/30m BPF. No red line and large adjustment slot	E690001	8

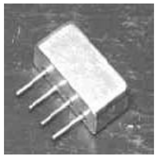
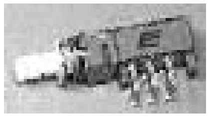
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	L31	12µH , Shielded	solenoidal, shielded (BLACK)	E690019	1
	L33	**Pre-wound** toroidal inductor, 41 µH, 5%, T44-7 core	**FRAGILE LEADS--HANDLE WITH CARE. SEE TEXT FOR MOUNTING INSTRUCTIONS USING 1/8W RESISTOR**	E690018	1
	L21, L22, L23, L24	T44-10	Toroid (BLACK); 12/10m LPF(.32µH, .26µH); 17/15mLPF(.45µH)	E680009	4
	L16, L17, L18, L19, L20, L25, L26	T44-2	Toroid (RED); 80m LPF(2.50µH); 20/30m LPF(.58µH, .44µH, .37µH); 40M LPF (1.25µH, 0.89µH)	E680012	7
	L5	33µH solenoidal	orange-orange-black	E690007	1
	RFC6	0.68µH solenoidal	blue-gray-silver	E690008	1
	RFC1, RFC2, RFC12, RFC13,	100µH solenoidal	brown-black-brown	E690004	4
	RFC4, RFC5, RFC8, RFC9	10µH solenoidal	brown-black-black	E690009	4
	RFC15	100µH solenoidal, subminiature	brown-black-brown	E690013	1
	RFC7	15µH solenoidal	brown-green-black	E690006	1
	RFC10	1mH solenoidal	brown-black-red	E690010	1
	RFC3, RFC11, RFC14, RFC16		0.37" dia. ferrite core (GRAY) RFC3, 47µH, 16T; RFC11, 100µH, 20T RFC14, 18µH, 10T; RFC16, 47µH, 16T		
	T1, T2, T6, T7	FT37-43	0.37" dia. ferrite core (GRAY) T1, 9:3T; T2, 12:8T; T6, 10T bifilar; T7, 5:20T	E680003	8
	T3 FT50-43	FT50-43	Toroidal transformer on 0.50" dia. ferrite core (GRAY). 5T bifilar.	E680008	1
	T5 T50-6	T50-6	Toroidal transformer on 0.50" dia. iron-powder core (YELLOW), 1.3µH, 16:4T	E680010	1

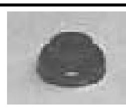
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	T4	Binocular core	2:3:1:1, Balun Core; Square, Two Holes	E690011	1
	Z1, Z2	Ferrite Bead	2 (GRAY) ferrite beads ea. on bare wire (see text)	E980029	4
	P1	20 x 1 ,male, RA	20 pin male, right angle. To Front Panel, J1	E620029	1
	P5	2p,male	2 pin male. For Speaker; Locking Ramp	E620024	1
	Q5, Q21, Q22	2N5109	Pre-Amp, Post Amp, Pre-Driver	E580013	3
	Q7, Q8	2SC1969	Push-Pull Finals	E580008	2
	Q6	2SC 5739 or 2SC2166	Driver	E580007	1

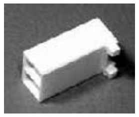
Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	Q10, Q12, Q17, Q20, Q23	2N7000	TO-92	E580002	5
	Q18, Q19, Q24	J310	TO-92	E580012	3
	Q11, Q13, Q16, Q25	PN2222A	TO-92	E580001	4
	Q2	ZVN4424A	Slightly Thinner TO-92 Style	E580005	1
	R115	0.05 ohm	1%, 3W Current Sense, (BLACK)	E500050	1
	R116	5.1 megohm	5%, 1/8W (grn-brn-grn); for L33--see text	E500086	1
	R68	226	(BLUE) 1%, 1/4 watt	E500033T	1
	R67	1.5k	(BLUE) 1%, 1/4 watt	E500034T	1
	R50	1.5 ohm	(TAN) 5%,**1/2 watt**	E500025T	1
	R42, R53, R54, R83	4.7 ohm	(TAN) 5%,1/4 watt	E500062T	4
	R76	10	(TAN) 5%, 1/4 watt	E500054T	1
	R82, R84	18	(TAN) 5%, 1/4 watt	E500061T	2
	R43, R78, R112	22	(TAN) 5%, 1/4 watt	E500028T	3
	R15, R55, R56, R92, R97	33	(TAN) 5%, 1/4 watt	E500036T	5
	R45, R47, R74	47	(TAN) 5%, 1/4 watt	E500019T	3
	R7	68	(TAN) 5%, 1/4 watt	E500058T	1
	R35, R36, R94, R113	82	(TAN) 5%, 1/4 watt	E500038T	4
	R6, R8, R60, R64, R89	100	(TAN) 5%, 1/4 watt	E500010T	5
	R30, R48, R49, R61	120	(TAN) 5%, 1/4 watt	E500022T	4
	R85	150	(TAN) 5%, 1/4 watt	E500011T	1
	R58	180 ohm	(TAN) 5%, **1/2 watt**	E500049T	1
	R1, R2, R63, R77	220	(TAN) 5%, 1/4 watt	E500002T	4
	R20, R46, R98, R99	270	(TAN) 5%, 1/4 watt	E500039T	4
	R10, R40, R72, R88, R90	470	(TAN) 5%, 1/4 watt	E500003T	5
	R11, R12, R41	560	(TAN) 5%, 1/4 watt	E500046T	3

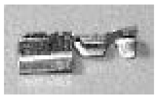
Appendix A	**K2 RF Board Parts List (p/n E850001A and E850001B)**				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	R75, R80	680	(TAN) 5%, 1/4 watt	E500040T	2
	R91, R93, R100	820	(TAN) 5%, 1/4 watt	E500001T	3
	R38, R39	1K	(TAN) 5%, 1/4 watt	E500013T	2
	R79, R81	1.8K	(TAN) 5%, 1/4 watt	E500004T	2
	R5, R19, R24, R25, R34, R44, R62, R66, R73, R95, R96	2.7K	(TAN) 5%, 1/4 watt	E500005T	11
	R114	3.9K	(TAN) 5%, 1/4 watt	E500009T	1
	R59	4.7K	(TAN) 5%, 1/4 watt	E500047T	1
	R110, R111	5.6K	(TAN) 5%, 1/4 watt	E500007T	2
	R13, R14, R29, R31, R32, R65, R101	10K	(TAN) 5%, 1/4 watt	E500015T	7
	R33	15K	(TAN) 5%, 1/4 watt	E500060T	1
	R28	27K	(TAN) 5%, 1/4 watt	E500056T	1
	R9, R16, R17, R21, R37, R69, R107	100K	(TAN) 5%, 1/4 watt	E500006T	7
	R18	1M	(TAN) 5%, 1/4 watt	E500024T	1
	R22	3.3M	(TAN) 5%, 1/4 watt	E500021T	1
	RP4,RP5	100K,3R ISO; "6A3-104G"	SIP; resistor pack, 6 pins; ALT: "77063104"	E510017	2
	RP6	100K,4R ISO; "8A3-104G"	SIP; resistor pack, 8 pins; ALT: "77083104" or "B104G"	E510018	1
	RP3	n/a	Thermistor board installed here (see text)	n/a	0
	RP2	10K,4R ISO; "8A3-103G"	SIP; resistor pack, 8 pins; ALT: "77083103"	E510005	1
	TP1, TP2, TP3	test point, female	VFO, BFO, PLL REF test points	E620036	3
	U1	16F872	Relay Driver PIC; I/O Controller; programmed	E610004	1
	U2	78L06AWC	TO-92, 6v Reg. For relays	E600001	1

Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	U3, U9	LT1252	8 pin DIP, VFO Buffer; TX Buffer	E600020	2
	U5	LTC1451	8 pin DIP, 12-Bit DAC for Reference Freq. Of PLL	E600030	1
	U6	LMC662	8 pin DIP, (rail-to-rail out); PLL Loop filter	E600026	1
	U10, U11	NE/SA602	8 pin DIP, mixer; alt: NE/SA612	E600006	2
	U12	SMT1A	IF Amp/AGC SMC on daughterboard with 2 ea. 4-pin headers.	E1200013	1
	U8	78L05	5-volt reg. (100mA)	E600029	1
	U4	MC145170P2 (or P1)	16 pin DIP, PLL	E600016	1
	W1, W2, W3, W5, W6	1" bare wire	Use component leads		0
	X1 (X2 not used)	12096 kHz	PLL reference oscillator crystal; HC-49	E850007	1
	X3, X4	4915.2 kHz	BFO crystals; matched set; HC-49 Typical labeling: ECS D 4.91 -S	E850008	2
	X5, X6, X7, X8, X9, X10, X11	4913.6 kHz	Filter crystals; matched set, HC-49 Typical labeling: ECS V 4.9136-S	E850006	7
	Z5	4.000MHz Resonator	Ceramic resonator w/caps; 0.2% tolerance	E660001	1

Appendix A	K2 RF Board Parts List (p/n E850001A and E850001B)				
PICTURE	Designators	Value	Description	Part Number	QTY
	Z6	TUF-1 or TOP-1	Balanced diode mixer	E980025	1
	S1	DPDT	Power Switch	E640006	1
	MISC	Keycap; TAC-BLK	Power Switch Keycap; rectangular	E980023	1
	MISC	28 pin socket, 0.3" DIP	Socket for U1	E620011	1
	MISC	PLL Upgrade parts	Small envelope; contents listed on page 49 of the manual	E850146	1
	HW	heatsink TO5 Flush	Crown heatsink; for Q22	E700029	1
	HW	standoff, 1/8"H x 1/4" D, phenolic (COLOR: BROWN)	For PA Transistor Mounting	E700034	2
	HW	stem bumper, 0.5" dia., black rubber	For L33 (BFO)	E980005	1
	HW	washer, nylon, #4	0.375" diameter (For T5)	E700035	1
	HW	4-32, nut, nylon	nut, nylon (For T5)	E700021	1
	HW	4-32,screw, nylon x 1/2"	screw, pan head, nylon (For T5)	E700022	1

Appendix A	K2 Misc. Bag Parts List (p/n E850004)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	HW	#4 lockwasher	internal tooth	E700010	41
	HW	2-56,screw , 1/8", STAINLESS	fillister head, **STAINLESS** 2-56 x 1/8”,slotted, for LCD bezel	E700023	4
	HW	2-D Fastener	Chassis fasteners	E100078	11
	HW	4-40 nut, Steel-ZN		E700011	18
	HW	4-40 screw, 3/8”, black	pan-head Phillips screw, black oxide steel (incl. spares)	E700008	11
	HW	4-40 screw, 3/16", black	pan-head Phillips screw, black oxide steel (incl. spares)	E700015	56
	HW	4-40 screw, 82 deg. Flt Hd, black	3/16”, flathead Phillips, 82 deg, 0.21 dia head, black oxide steel (front panel)	E700025	1
	HW	4-40 screw 1/2", black	Phillips, for mounting PA transistors	E700030	2
	HW	4-40 screw 7/16", steel-ZN	Phillips, for mounting feet and tilt stand	E700032	6
	HW	4-40 standoff 1/4" long x 3/16"	Threaded	E700026	5
	HW	4-40 standoff, 1/2" x 1/4" Dia.	Threaded hex 0.5" x 0.25" dia.	E700007	2
	HW	Shoulder washer, nylon, black	For PA transistors	E700001	2
	HW	Cable tie - Small	For speaker wiring and RF probe	E980002	4
	HW	Tilt stand set + 4 feet	Two oval front feet, tilt stand, two rear feet	E980019	1
	HW	#4 washer, fibre, black	For speaker and PA transistor mounting	E700031	6
	**SPK**-J2	1/8” phone jack, mono w/switch	Panel-mount jack for ext. speaker	E620035	1

Appendix A	K2 Misc. Bag Parts List (p/n E850004)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	**SPK**-J1	2 pin female conn. Housing	0.1" spacing w/locking ramp, int. speaker plug	E620021	1
	**ACC**-P1	2.1mm male conn.	Mates with DC power jack	E620032	1
	**ACC**-P2	stereo 1/8" phone plug	Plug for hand key/keyer/paddle/computer input	E620033	1
	Misc	female crimp pins	For 2-pin speaker housing (SPK-J1)	E620022	2
	Misc	plastic tuning tool, p/n MARS-12	For aligning slug-tuned inductors (GREEN)	E980012	1
	Misc	Allen wrench	Long-handled, for large knobs and for Control board removal	E980004	1
	Misc	Allen wrench	Short-handled, for small knobs	E980008	1

Appendix A	K2 Misc. Bag Parts List (p/n E850004)				
	K2 Probe Assemblies Parts List (p/n E850036 envelope in E850004 Misc bag)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	FCP-C1	10pf cap	Axial Leads (like a resistor); counter probe	E530067	1
	RFP-C1	.01 µF cap	Monolithic capacitor, for optional RF probe	E530009	1
	RFP-D1	1N34A diode	For RF probe; germanium	E560000	1
	FCP-E1	1 pin male probe tip	For counter probe	E620044	1
	**FCP**-J1, **VMP**-J1	2 pin female housing	For counter and voltmeter probes	E620021	2
	Misc	female crimp pins	For counter and voltmeter probes	E620022	3
	Misc	Aligator clip, insulated	For RF probe (ground)	E700074	1
	Misc	Banana plug, red	For RF probe (DMM positive lead)	E700076	1
	Misc	Banana plug, black	For RF probe (DMM negative lead)	E700075	1
	RFP-R1	4.7M Resistor	5%, 1/4W; For RF probe	E500048	1

Appendix A	K2 Wire Bag Parts List (p/n E850005 bag)				
PICTURE	**Designators**	**Value**	**Description**	**Part Number**	**QTY**
	Misc	#26 Red Enamel Wire	For toroids	E760002	30 ft
	Misc	#26 Green Enamel Wire	For toroids	E760004	8 ft
	Misc	Green solid hookup wire, #24	Insulated wire for T4, misc. wiring	E760008	3 ft
	Misc	White solid hookup Wire, #24	Insulated wire for T4, misc. wiring	E760013	1 ft
	Misc	Black stranded hookup wire, #24	For RF probe	E760016	6"
	Misc	RG174 Coax Cable	For counter and RF probes	E760010	3 ft
	Misc	#24 Dual-conductor speaker wire	For speaker and ext. speaker jack	E760012	2 ft
	Misc	Grill Cloth	Must be cut to speaker size; see text	E850089	3x3"
	Misc	Heat Shrink; 3/16" dia.	For counter probe.	E980028	4"

Relay Table

Band	BPF	LPF	VCO
	SET Relays		
160m	K2	160m-K1	-
80m	K2, K3	K8	K13
+60m	K1, 60m-K1	K12	K13, K14
*40m ALT	K1	K12	K13, K14
40m	K1	K12	K14
30m	K3, K4	K9	K14, K15
20m	K4	K9	K13, K14, K15
17m	K5	K11	K13, K15
15m	K5, K6	K11	K15
12m	K6, K7	K10	K13, K14, K15
10m	K7	K10	K13, K15

+ 60 meters is available only if the K60XV option is installed.
*40m ALT applies if D19-D20 are not installed.
NOTE: All relays are single-coil latching type and are shown in the RESET position in schematics. Relay pins 5 and 6 are not connected internally.

VCO Table

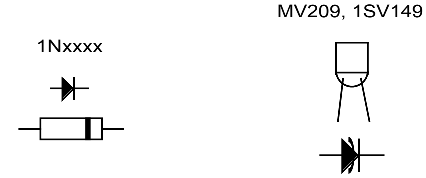
Band	Fixed Cap., pF	Total Cap., pF*	VCO Freq. at band edge**
160m	C75 (470)	525-629	6715 (subtract)
80m	C72 (270)	325-429	8415 (subtract)
60m	C71+C73 (129)	215-259	10165 (subtract)
***40m ALT	C71+C73 (129)	163-209	11915 (subtract)
40m	C71 (120)	154-203	11915 (subtract)
30m	C73+C74 (67)	102-131	14915 (subtract)
20m	C74 (20)	55-84	18915 (subtract)
17m	none (0)	35-64	22915 (subtract)
15m	C73 (47)	82-111	16085 (add)
12m	C74 (20)	55-84	19975 (add)
10m	none (0)	35-64	23085 (add)

* This includes capacitance of varactor diodes D23-D26 on all bands, D21-D22 on 80 -160 m, and D19-D20 on 40 and 60 meters (if applicable). Only a portion of the indicated capacitance range is actually used to cover each Amateur band segment. VCO frequency can be calculated based on a total inductance of 0.95 µH (T5 in parallel with L30).

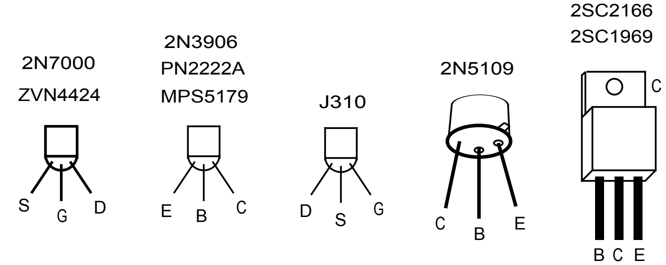
** Based on an I.F. of 4915 kHz (e.g., 6715 - 4915 = 1800). 5250 kHz used as 60-meter lower band edge (pending U.S. FCC ruling).

***40m ALT applies if D19-D20 are not installed.

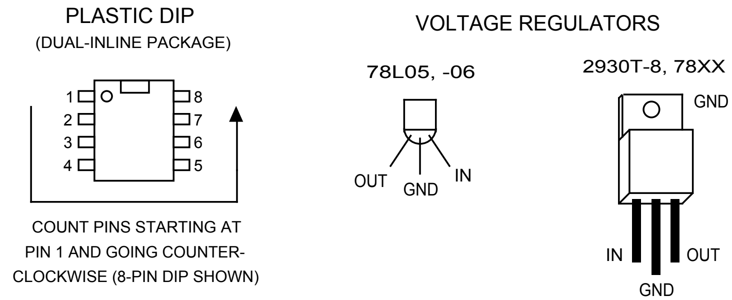
Diodes



Transistors



Integrated Circuits



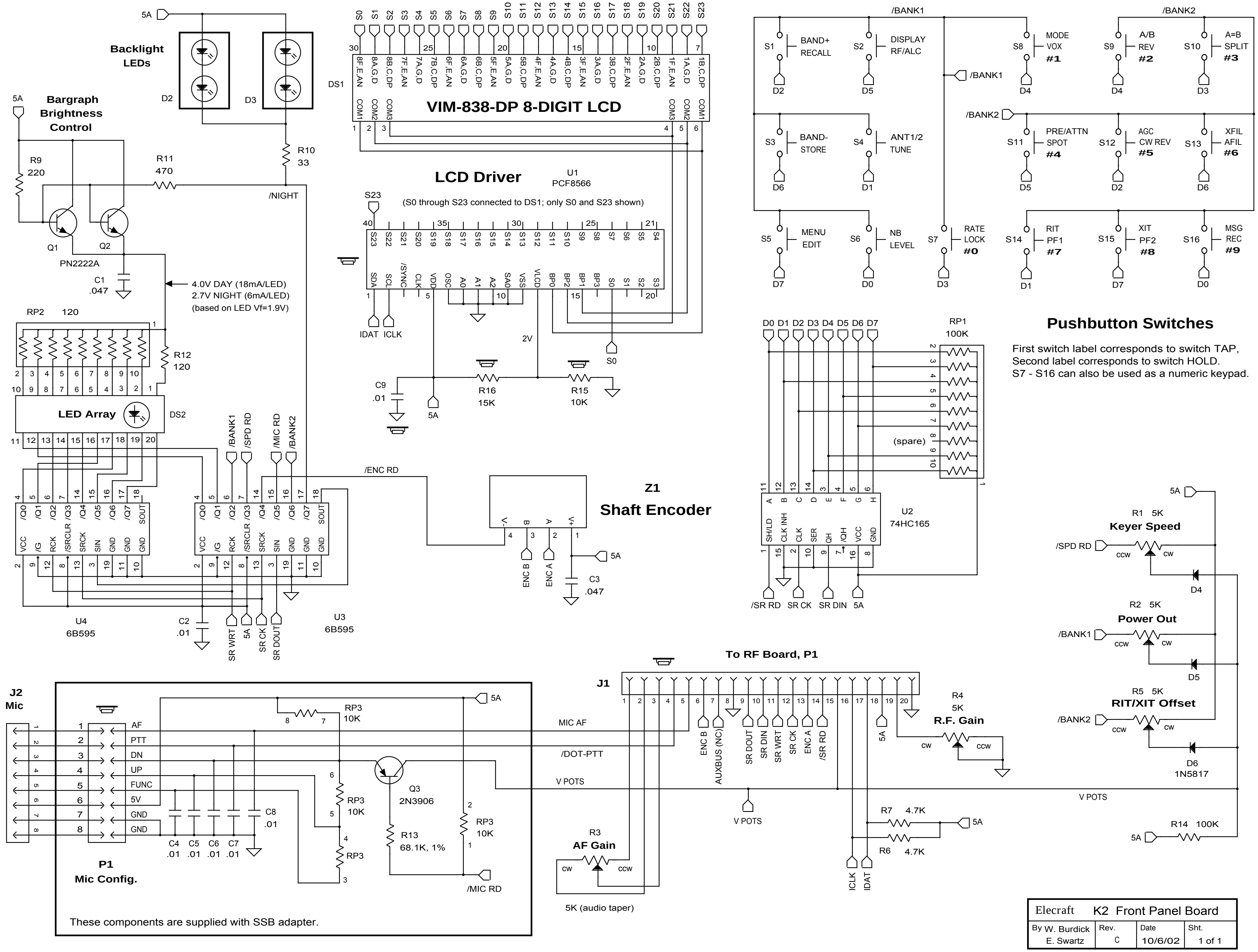
Special Symbols

 = On bottom of PC board.

 Jumper

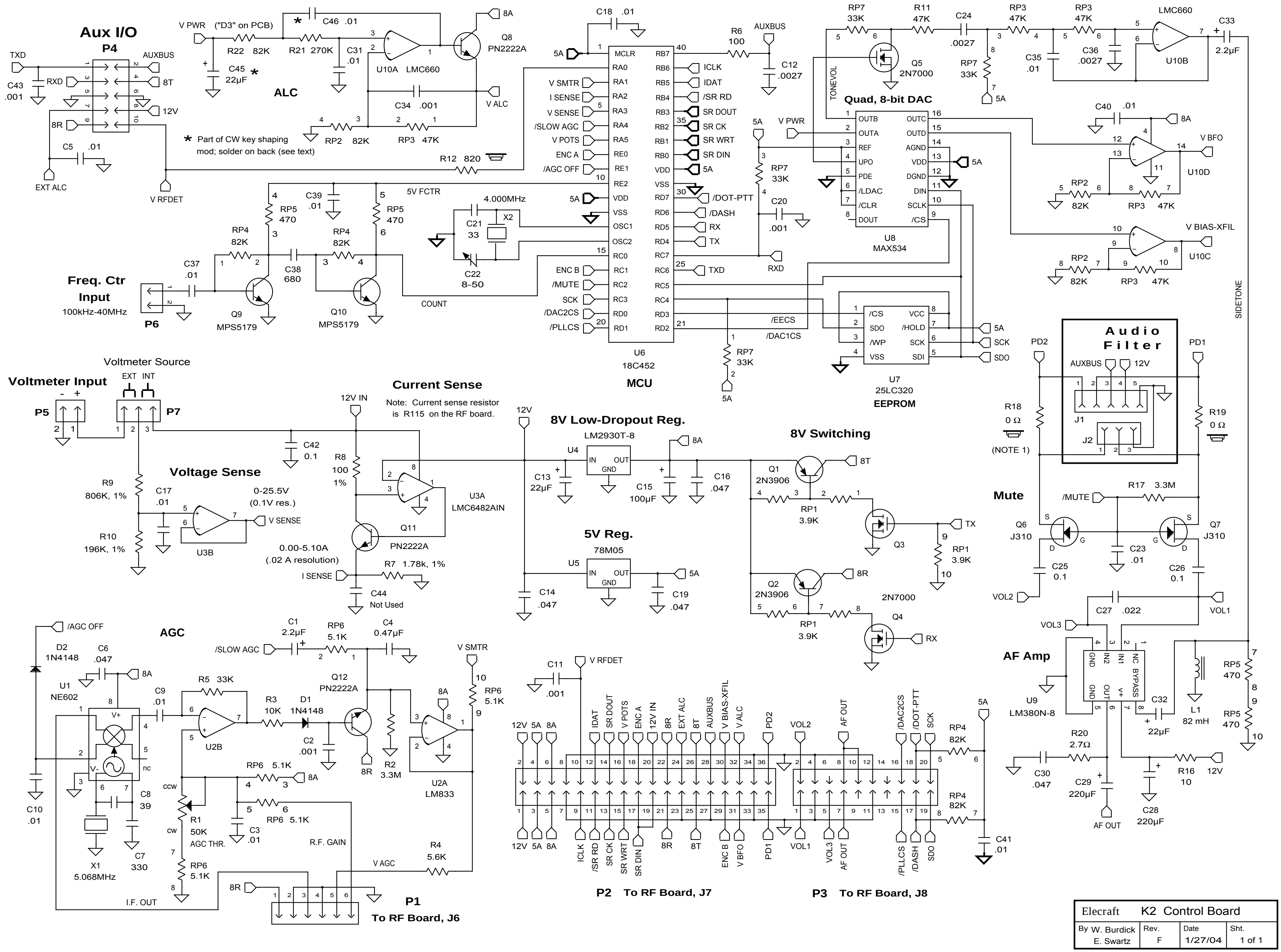
Elecraft	K2 Schematic Key		
By W. Burdick E.Swartz	Rev. D	Date 10/23/02	Sht. 1 of 1

Appendix B



Backlight LEDs
Bargraph Brightness Control
VIM-838-DP 8-DIGIT LCD
LCD Driver
U1 PCF8566
(S0 through S23 connected to DS1; only S0 and S23 shown)
4.0V DAY (18mA/LED)
2.7V NIGHT (6mA/LED)
(based on LED Vf=1.9V)
LED Array
Z1
Shaft Encoder
U4 6B595
U3 6B595
U2 74HC165
Pushbutton Switches
First switch label corresponds to switch TAP,
Second label corresponds to switch HOLD.
S7 - S16 can also be used as a numeric keypad.
Keyer Speed
Power Out
RIT/XIT Offset
R.F. Gain
AF Gain
5K (audio taper)
To RF Board, P1
J2 Mic
P1 Mic Config.
These components are supplied with SSB adapter.
Elecraft
K2 Front Panel Board
By W. Burdick E. Swartz
Rev. C
Date 10/6/02
Sht. 1 of 1

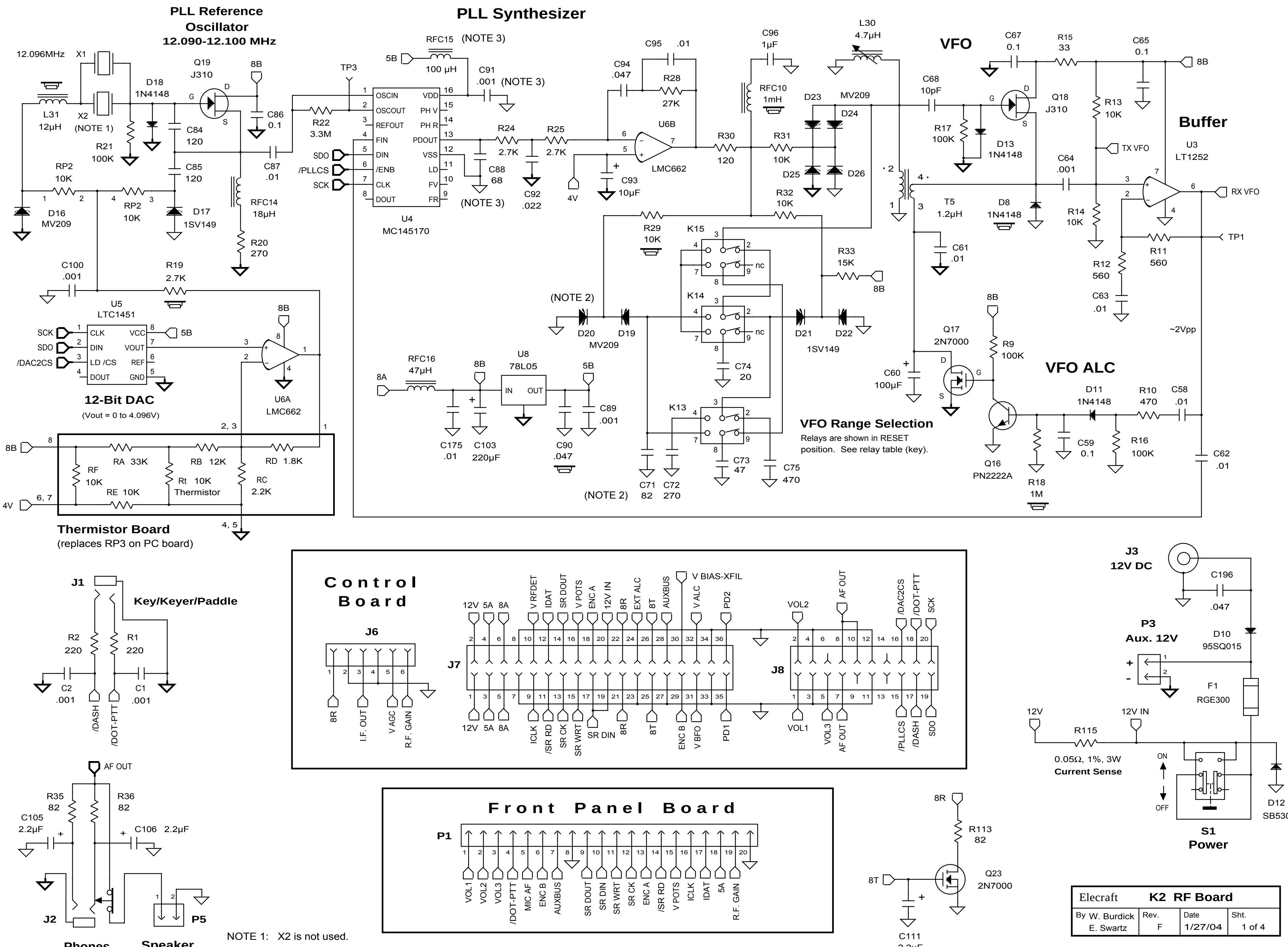
Appendix B



NOTE 1: Jumpers are used at R18 and R19. They must be removed if the Audio Filter option is installed.

= on bottom of PC board

Appendix B



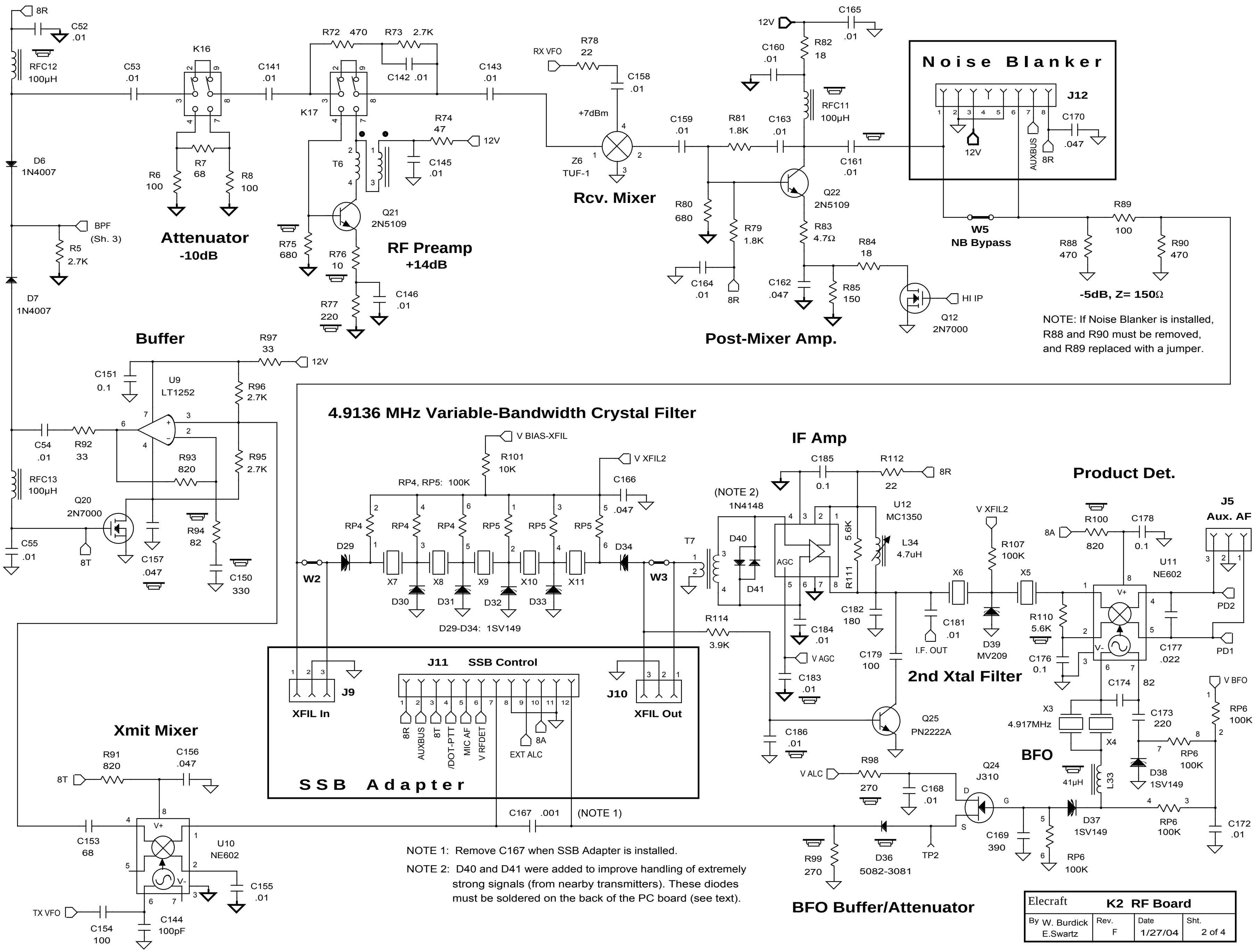
NOTE 1: X2 is not used.

NOTE 2: D19-D20 are supplied with the K60XV option. They must not be installed unless the K60XV option is also installed (60 m band and transverter I/O). C71 must be changed to 120 pF if D19-D20 are installed.

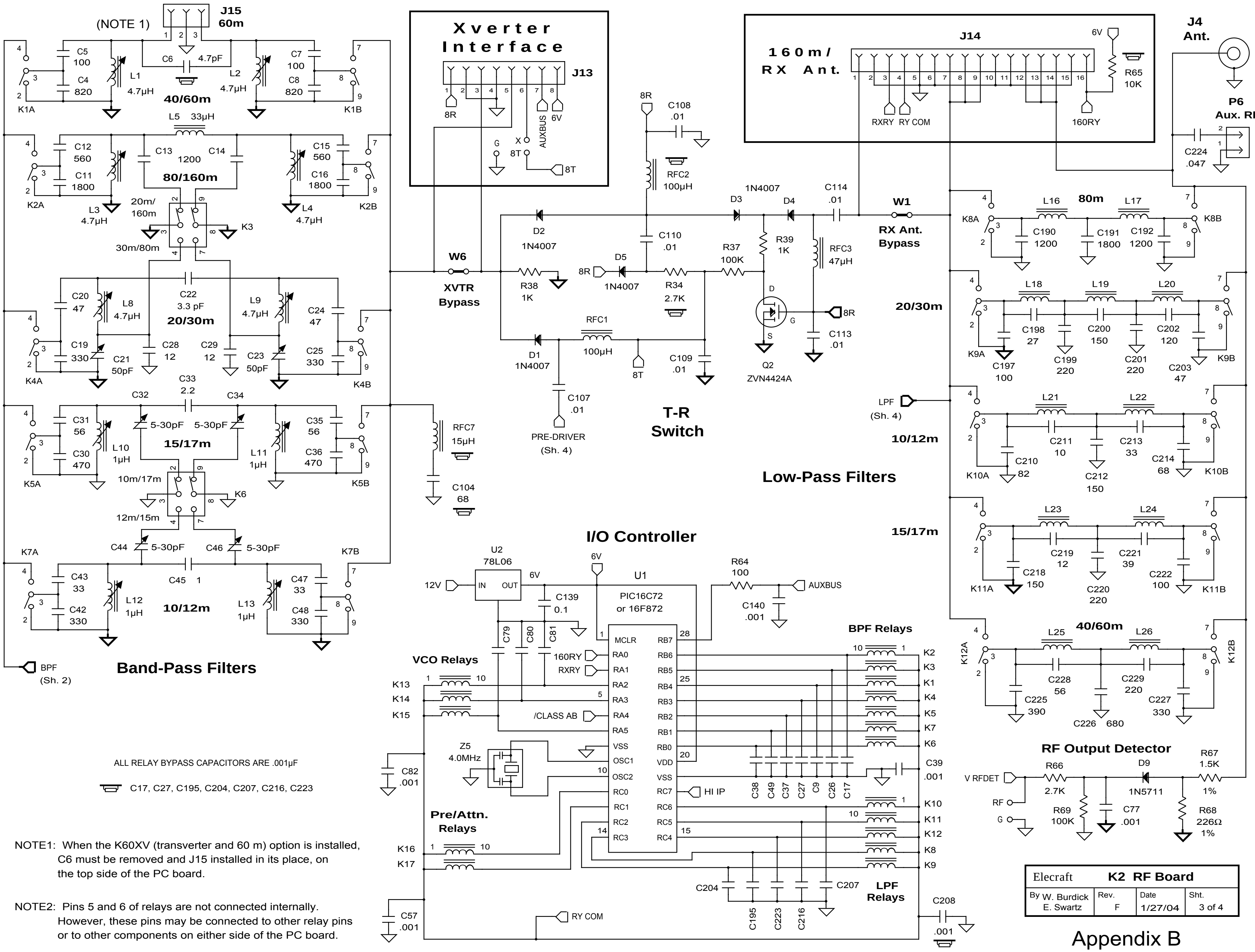
NOTE 3: These components improve PLL stability; they must be soldered on the back of the board (see text).

Elecraft	K2 RF Board		
By W. Burdick E. Swartz	Rev. F	Date 1/27/04	Sht. 1 of 4

Appendix B


Attenuator
-10dB
RF Preamp
+14dB
Rcv. Mixer
Post-Mixer Amp.
Noise Blanker
W5
NB Bypass
-5dB, Z= 150Ω
NOTE: If Noise Blanker is installed, R88 and R90 must be removed, and R89 replaced with a jumper.
Buffer
4.9136 MHz Variable-Bandwidth Crystal Filter
IF Amp
Product Det.
J5
Aux. AF
D29-D34: 1SV149
(NOTE 2)
1N4148
2nd Xtal Filter
BFO
SSB Adapter
J11 SSB Control
XFIL In
XFIL Out
Xmit Mixer
(NOTE 1)
NOTE 1: Remove C167 when SSB Adapter is installed.
NOTE 2: D40 and D41 were added to improve handling of extremely strong signals (from nearby transmitters). These diodes must be soldered on the back of the PC board (see text).
BFO Buffer/Attenuator
Elecraft
K2 RF Board
By W. Burdick E.Swartz
Rev. F
Date 1/27/04
Sht. 2 of 4

Appendix B

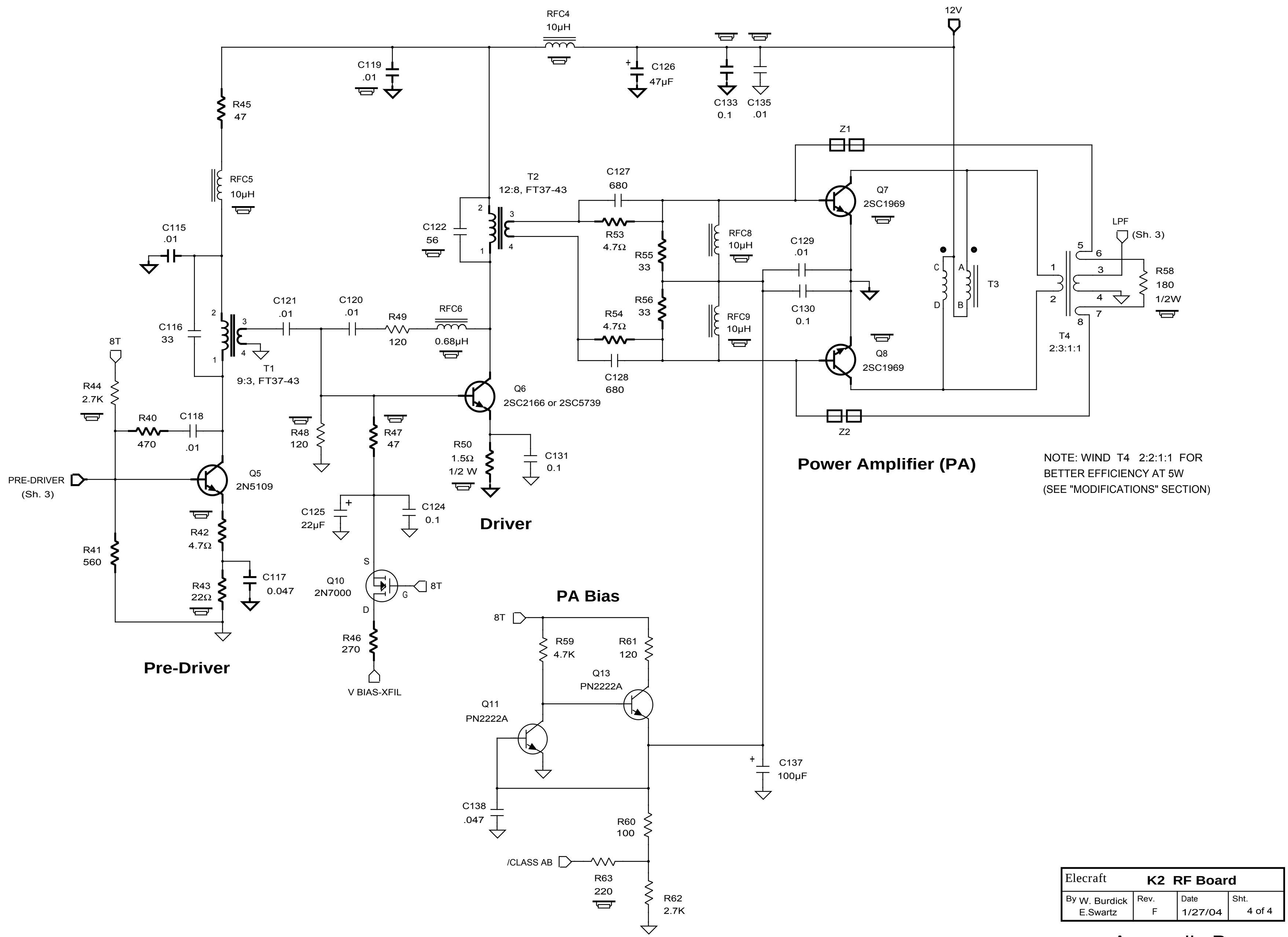


NOTE1: When the K60XV (transverter and 60 m) option is installed, C6 must be removed and J15 installed in its place, on the top side of the PC board.

NOTE2: Pins 5 and 6 of relays are not connected internally. However, these pins may be connected to other relay pins or to other components on either side of the PC board.

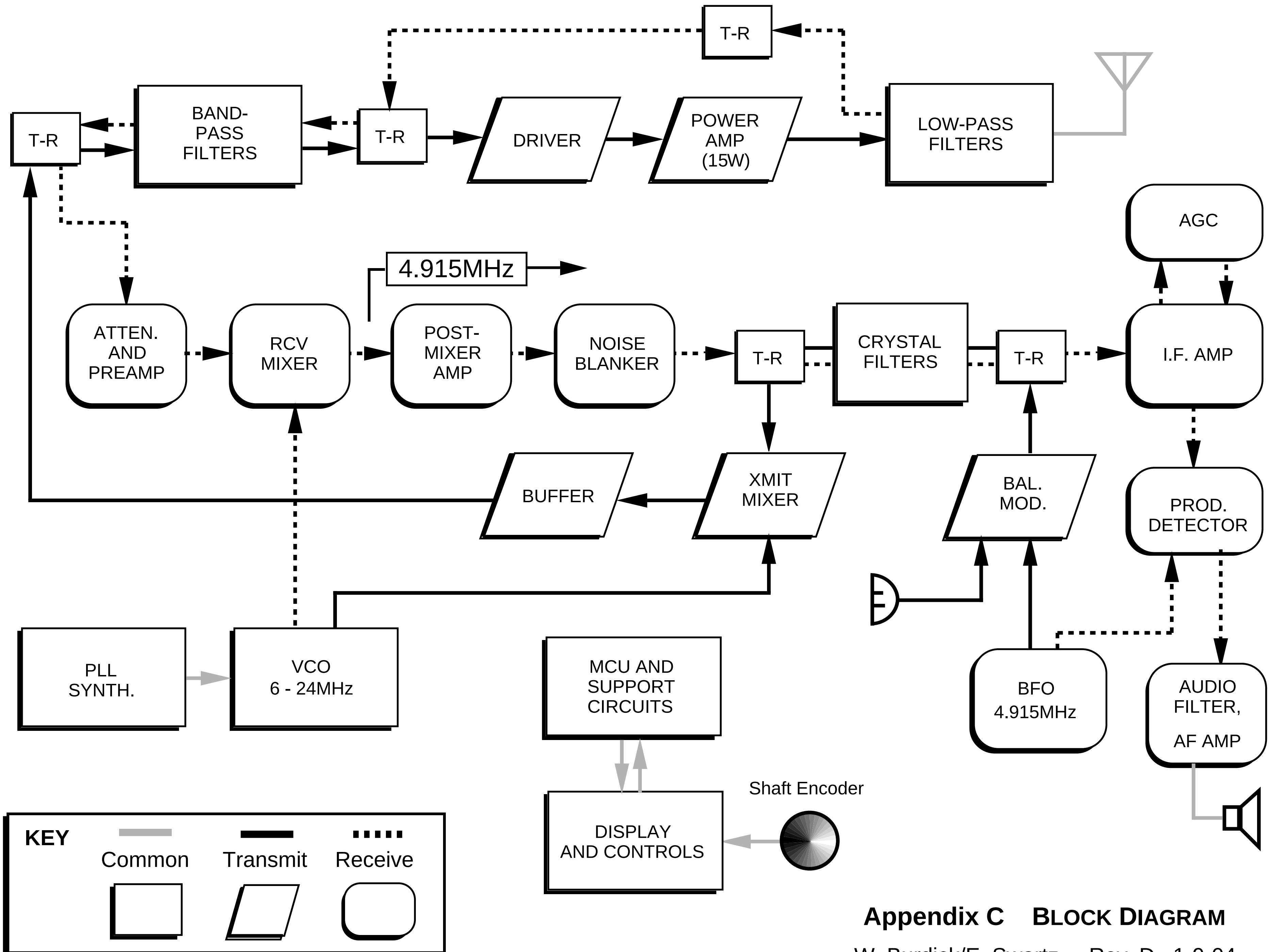
Elecraft	K2 RF Board		
By W. Burdick E. Swartz	Rev. F	Date 1/27/04	Sht. 3 of 4

Appendix B



12V
RFC4
10µH
C119
.01
C126
47µF
C133
0.1
C135
.01
R45
47
RFC5
10µH
C115
.01
T2
12:8, FT37-43
C127
680
C122
56
R53
4.7Ω
R55
33
RFC8
10µH
C129
.01
Z1
Q7
2SC1969
LPF
(Sh. 3)
R58
180
1/2W
T3
T4
2:3:1:1
C116
33
T1
9:3, FT37-43
C121
.01
C120
.01
R49
120
RFC6
0.68µH
R54
4.7Ω
R56
33
RFC9
10µH
C130
0.1
Q8
2SC1969
C128
680
Z2
8T
R44
2.7K
Q6
2SC2166 or 2SC5739
R40
470
C118
.01
R48
120
R47
47
R50
1.5Ω
1/2 W
C131
0.1
PRE-DRIVER
(Sh. 3)
Q5
2N5109
C125
22µF
C124
0.1
Driver
Power Amplifier (PA)
NOTE: WIND T4 2:2:1:1 FOR
BETTER EFFICIENCY AT 5W
(SEE "MODIFICATIONS" SECTION)
R41
560
R42
4.7Ω
C117
0.047
R43
22Ω
Q10
2N7000
S
G
D
8T
R46
270
V BIAS-XFIL
Pre-Driver
PA Bias
8T
R59
4.7K
R61
120
Q13
PN2222A
Q11
PN2222A
C137
100µF
C138
.047
R60
100
/CLASS AB
R63
220
R62
2.7K
Elecraft
K2 RF Board
By W. Burdick
E.Swartz
Rev.
F
Date
1/27/04
Sht.
4 of 4

Appendix B



Appendix C BLOCK DIAGRAM

W. Burdick/E. Swartz Rev. D 1-9-04

Appendix D - K2 Detail Pictures

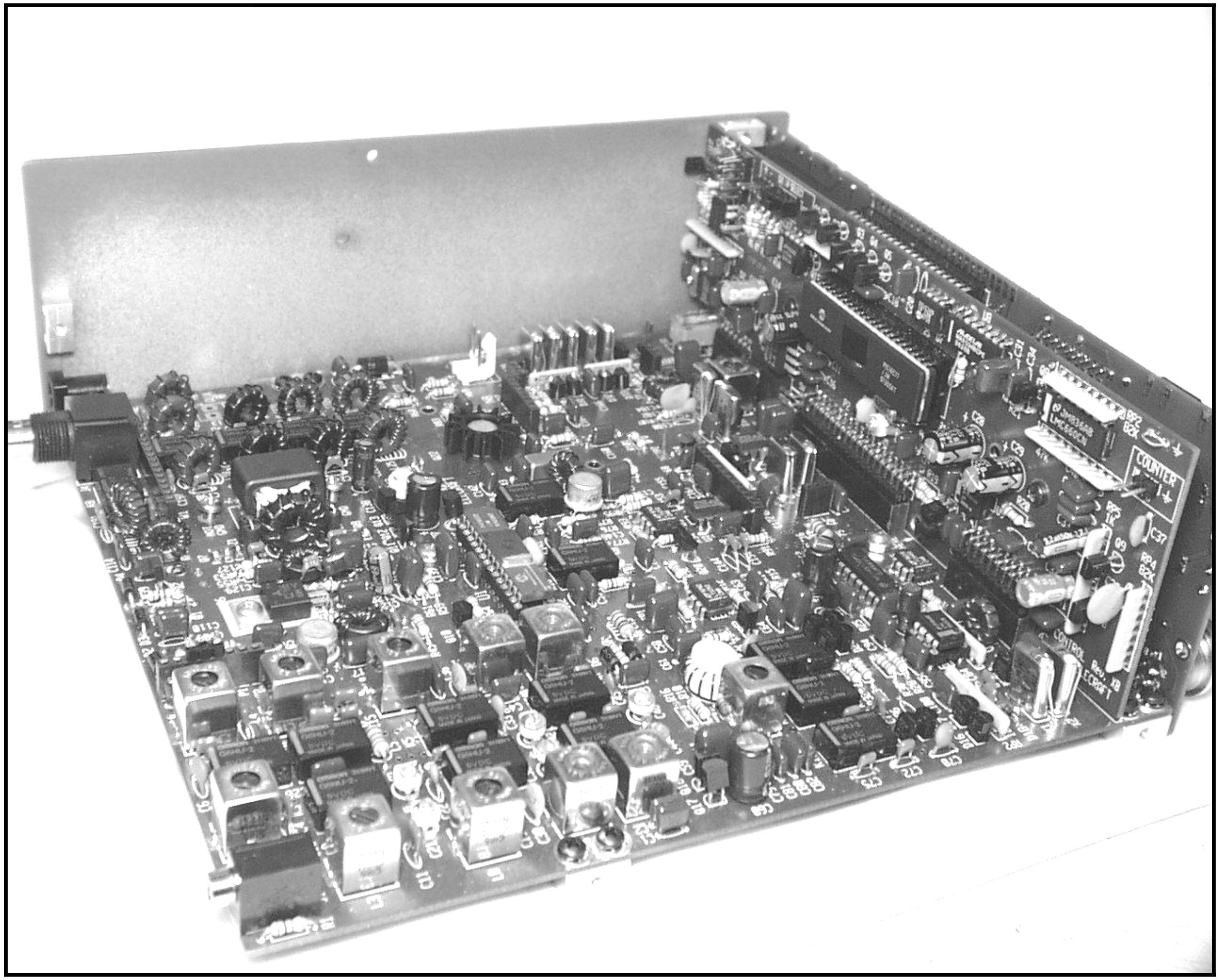


Figure 1

K2 rear right view with side panel removed.

Appendix D - K2 Detail Pictures

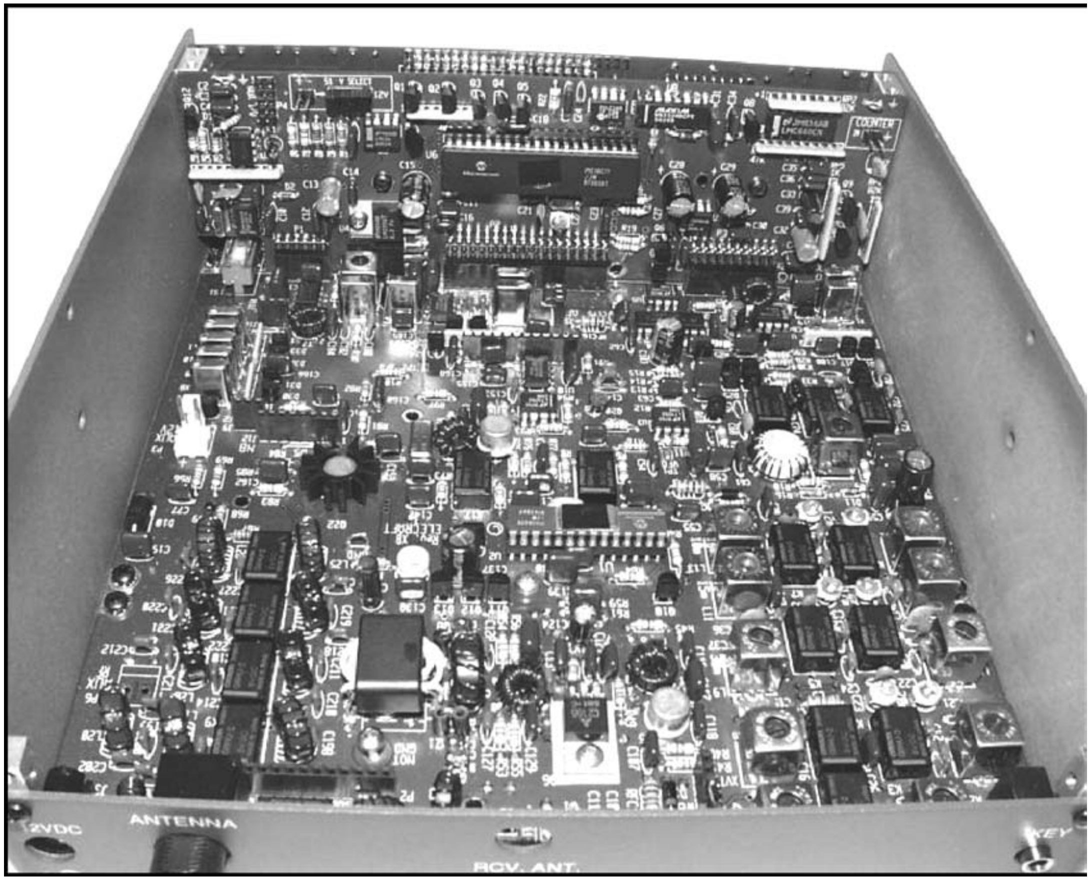


Figure 2

K2 Rear View

Appendix D - K2 Detail Pictures

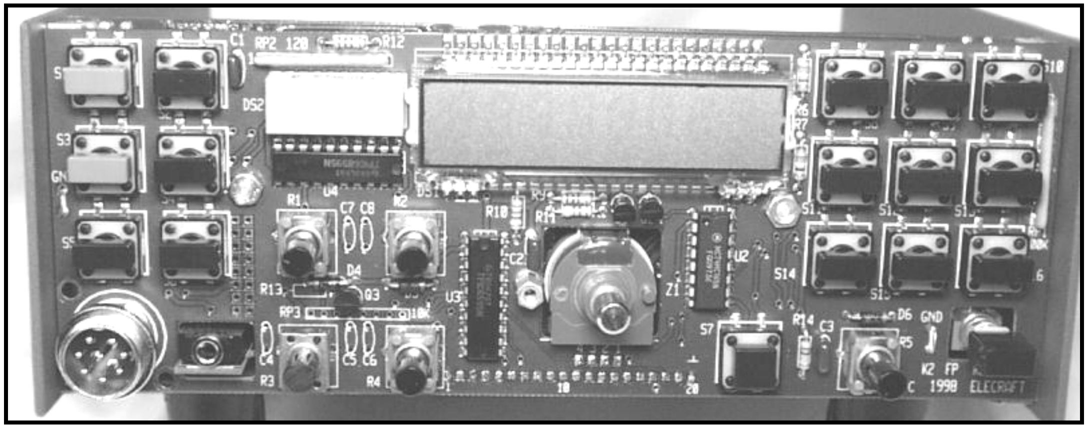


Figure 3

K2 Front Panel PCB

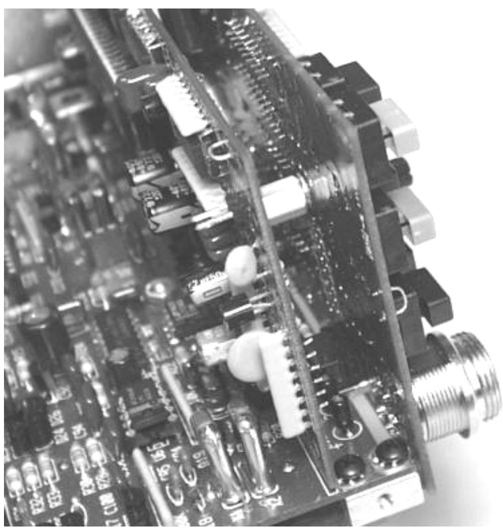


Figure 4

Detail of Control to Front Panel PCB Mounting.

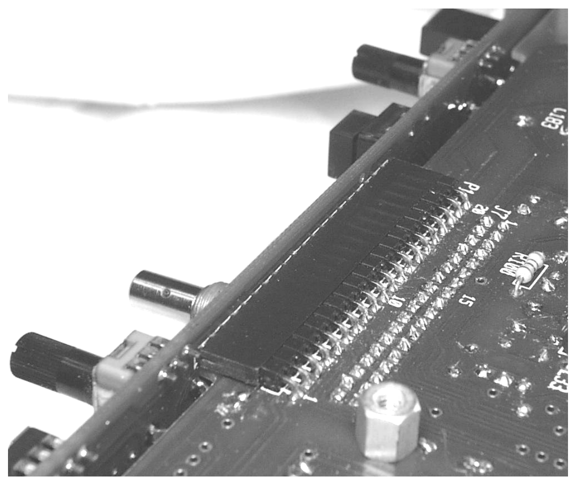


Figure 5

Detail of P1 (bottom of RF board) to Front Panel

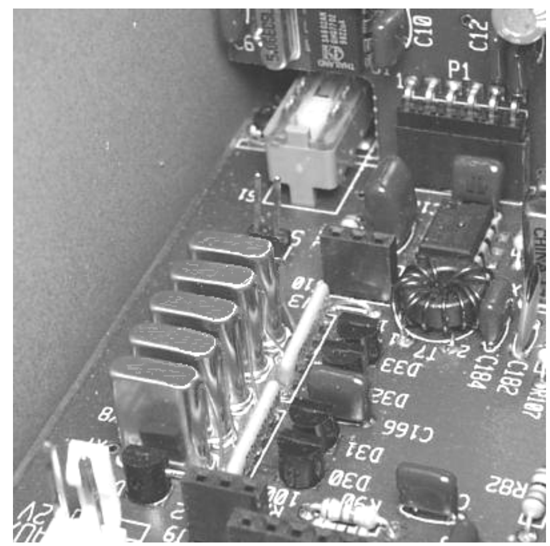


Figure 6

Five pole 4.915MHz crystal filter detail.

Appendix D - K2 Detail Pictures

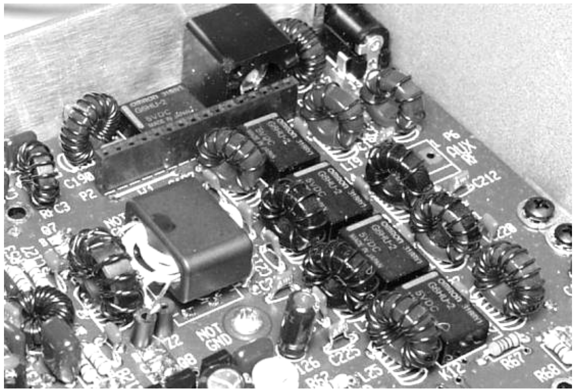


Figure 7

PA and Low Pass Filter Detail

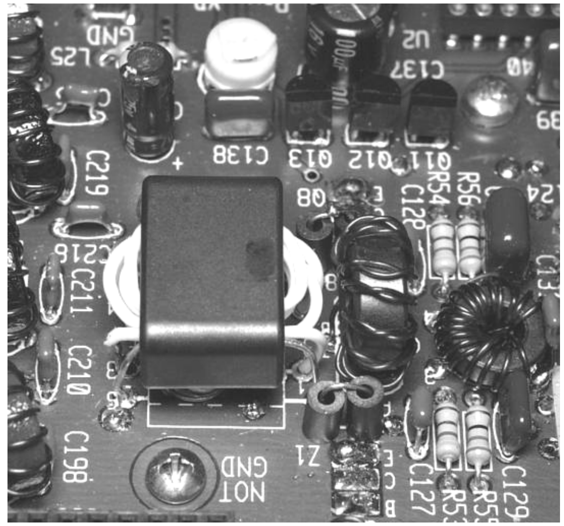


Figure 8

PA transformer (T4), Bifilar PA collector transformer (T3) and Driver to PA transformer, (T2). Z1, Z2 feedback ferrite beads are also shown.

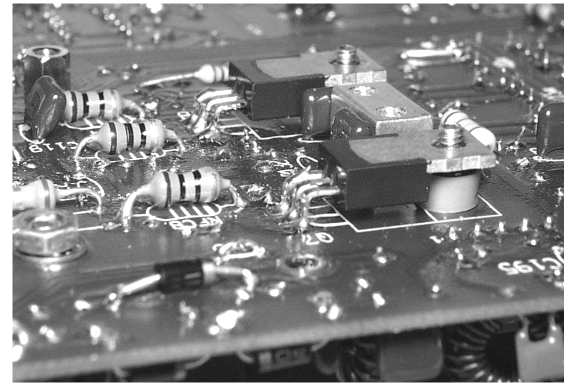


Figure 9

PA Transistor mounting detail on bottom of RF PCB. Right angle bend of transistor leads shown along with self-retaining mounting spacer and black shoulder washer (between spacer and transistor tab). 2D block shown between transistors.

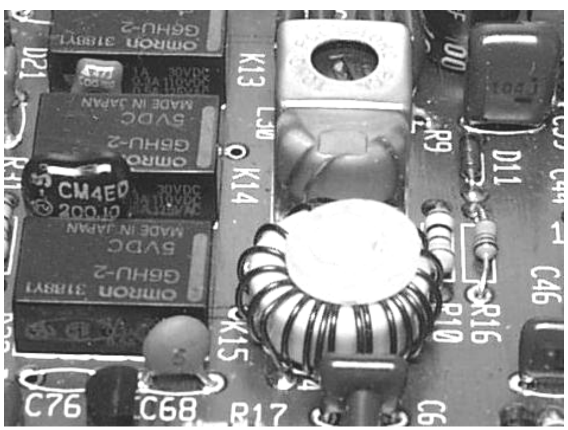


Figure 10

PLL VCO transformer (T5) detail. L30 and VCO relays are also shown

Appendix E, Troubleshooting

If you have any difficulty with your K2:

- Closely examine all PC boards for poor solder joints and incorrect, broken or missing components.
- Look for your problem in the **Troubleshooting Tables** (below).
- Follow the step-by-step receiver and transmitter **Signal-Tracing** procedures at the end of this section. Also included are complete **DC Voltage Tables** for all ICs and transistors.

Troubleshooting Tables

There are five troubleshooting tables (listed below). Within each table, problems are identified by 3-digit numbers in the ranges shown. In most cases you'll know which table to look in based on the symptoms you observe. If in doubt, start with the General Troubleshooting table.

General Troubleshooting	000-049
Control Circuits	050-099
Receiver	100-149
Transmitter	150-199
Operation and Alignment	200-249

When referring to components on the various K2 boards in the table, we will sometimes use a shorthand form such as "RF-U11," which means U11 on the RF board.

INFO Messages

If you see a message such as **INFO 100** on the LCD, look up the corresponding entry in the troubleshooting tables. **Note**: **INFO** messages can be cleared by pressing any switch. However, the cause of these messages should be investigated before continuing to operate the transceiver.

General Troubleshooting (000-049)

Problem	Troubleshooting Steps
000 Unit appears to be completely dead when power switch is turned on (no display, no audio)	▪ Make sure your power supply or battery is connected, turned on, and isn't plugged in backwards ▪ Check power supply and battery fuses if applicable ▪ The K2's internal self-resetting fuse, F1, may have gone into a high-resistance state due to a short from the 12-V line to ground; unplug the power supply and check for such shorts ▪ Examine power cable for shorts or opens ▪ Verify control board is plugged in and that its connectors are fully seated ▪ Check for 12 VDC at the power jack ▪ Make sure speaker, battery, and other internal option connectors are not swapped or plugged in backwards ▪ Measure the +5V and +8V regulated power supplies. If either is incorrect, check the regulators (**050**). ▪ Check the MCU (**075**)
003 LCD is dim	▪ Check values of R16 and R15 on the front panel ▪ Check continuity from LCD driver (U1) to LCD. Also look for bent pins on driver.
004 Display turns on but unit still appears functionally dead or is "running slowly"	▪ Check the MCU, Control-U6 (**075**) ▪ Verify that the control and front panel boards are plugged in correctly ▪ The MCU oscillator may be shorted out due to solder flux residue, especially if you used water-soluble flux solder (**030**)
005 No display, but audio is OK	▪ Remove the bottom cover and verify that the front panel connector is properly mated with the RF board ▪ If the front panel is plugged in correctly but the problem still persists, check all LCD voltages and control lines (**060**)

009 LO BATT displayed	▪ P7 on the control board may be jumpered for ext. 12V. Move the jumper to the "12V" pos. ▪ Battery voltage may be below 10.5V. Recharge the battery as soon as possible.
010 Battery voltage too low for proper voltage regulation	▪ If you saw INFO 010 on the LCD, your battery voltage is too low (< 8.5V). This usually happens on transmit when your battery is weak. Disconnect the battery from the K2 and measure its voltage; if the battery voltage quickly rises back to 11 or 12V, the K2 may be loading the battery down. But if the battery stays stabilizes at under about 10 V when measured outside of the K2, it has become fully discharged or may be defective. ▪ If you suspect the K2 is pulling the voltage down, tap any button to clear the INFO message then use DISPLAY to show the voltage and current drain. If the current drain is > 200 mA with no signal and the bargraph OFF, something is shorting either the 12V line or one of the regulators (**050**).
011 No audio, but display is OK	▪ Make sure that a working antenna is connected; check audio filter option, antenna switch, tuner, SWR bridge, etc. ▪ See Receiver Troubleshooting (**100**)
012 Display, VFO knob, switches, or potentiometers do not function correctly or are intermittent	▪ Front panel or control board may not be plugged in correctly ▪ Check the MCU (**075**) ▪ Check all regulated supply voltages (**050**) ▪ RP1 or RP2 on the front panel board may be installed backwards.
015 Current drain excessive on receive	▪ Check receive-mode current drain (**140**)
016 Current drain excessive on transmit	▪ Connect the K2 to a known 50 ohm load (preferably a dummy load); if current drain returns to normal, you probably have a mismatched antenna and will have to improve the match or reduce output power ▪ If you have set the power level control significantly above the level that the transmitter is capable of, current may increase significantly; try reducing the power setting or use CAL CUR to set up a current limit ▪ Use voltage/current monitor mode to see if the power supply voltage drops below 11V on transmit; if so, you may be exceeding the capability of your power supply or battery (**025**) ▪ If the supply voltage and antenna impedance are correct, the driver or PA transistors may not be operating efficiently (**150**)
018 Supply voltage drops when K2 is turned on	▪ Use voltage/current monitor mode to see if the receive-mode current drain is too high (**015**) ▪ If voltage drops but current drain is normal, you probably have a power supply problem or a battery that is not fully charged (**025**); review power supply requirements (Specifications)
019 Supply voltage drops too low when transmitter is keyed	▪ Use voltage/current monitor mode to see if transmit-mode current drain is too high (**016**) ▪ If voltage drops but current drain on transmit is normal, you probably have a weak battery or inadequate power supply (**025**)
025 Battery won't charge up to the correct voltage, or discharges too quickly	▪ Batteries must be charged using the right voltage or their usable life will be greatly reduced; if you have the K2 internal battery option, refer to the charging instructions in the option manual ▪ Battery life can be extended by reducing power output and by turning off selected features using the menu; see Operation ▪ Always disable the K2's internal battery using the rear-panel battery on-off switch if you plan to use an external battery or a reduced-voltage power supply that is inadequate for charging purposes
029 Small error in actual vs. displayed frequency	▪ Make sure your 4.000-MHz oscillator (control board, X2) is calibrated. Two methods are provided in the Operation section (Advanced Operating Features).

	▪ Make sure the bottom cover is installed when doing **CAL FIL** and **CAL PLL**. Also, if you calibrate at room temperature but operate the radio at much lower or higher temperatures, calibration will be worse. ▪ Re-do **CAL FIL** after calibrating the 4.000–MHz oscillator ▪ Re-do **CAL PLL** after calibrating the 4.000-MHz oscillator ▪ Use **CAL FCTR** with probe on TP1 and tune very slowly through about 10 kHz of VFO range; if you see any sudden jumps of > 50 Hz over this range even after doing CAL PLL, your 12.096-MHz oscillator crystal may be defective (RF, X1).
030 VFO frequency jumps or drifts, or operating frequency appears to be entirely incorrect	▪ You must align both the VCO and BFO using the **CAL PLL** and **CAL FIL** before operating the K2; otherwise the VFO cannot be tuned properly and the synthesizer may not be locked (see Operation as well as RF board Alignment and Test, Part II) ▪ Make sure the supply voltage is above 8.5V at all times or the 8V regulator may not function correctly. ▪ If you used solder with water-soluble flux, you may have conductive paths all over the PC boards. These can cause numerous problems with the VFO, BFO, and logic circuits (anything high impedance). Try cleaning the entire board with hot water and a Q-tip, or follow solder manufacturer's recommendations (except immersion). ▪ If you used **CAL FIL** to change the BFO settings, make sure you placed the BFO on the correct side of the zero-pitch value for each operating mode (see Operation, Filter Settings) ▪ If you tune beyond the lock range of the VCO, the frequency will stop changing and may "hunt" near the end of this range. If you are in a range that the VCO should be capable of tuning, re-check VCO alignment (see RF board Alignment and Test, Part II) ▪ If the displayed frequency is "garbage," see Resetting the Configuration to Defaults in Advanced Operating Features.

Control Circuits (050-099)

Problem	**Troubleshooting Steps**
050 Regulated voltage(s) incorrect	▪ Remove all option boards, since any one of them might be causing a short on a regulated supply line ▪ Make sure that the DC input voltage at J3 is > 8.5 (the minimum voltage needed by the voltage regulators) ▪ If +5V is too low (< 4.5V) go to **052** ▪ If +8V is too low (< 7.5V) go to **053**
051 General problem with control circuits (switches, knobs, display, bargraph, T-R switching)	▪ Check all DC voltages using the voltage tables (later in this section). Start with the control board. ▪ If the problem involves the front panel, measure those voltages next. If the problem is with T-R switching, check the RF board voltages next. You may have RP1 or RP2 on the front panel board installed backwards.
052 +5V too low (< 4.75V)	▪ Remove the front panel to see if it is was pulling the 5V line low. If not, the problem is likely to be on the control board. ▪ Pull the control board out and inspect the entire 5V line looking for heat-damaged components or shorts. The schematic can be used to identify components on the 5V line. ▪ Remove the microprocessor to see if it is loading the 5V line down. ▪ Unsolder the output pin of the 5V regulator and bend it up slightly to break contact with the PC board. If the voltage is still too low measured at the pin, replace the regulator.

053 +8V too low (< 7.5V)

- Inspect the entire 8V path on the RF and control boards. Look for heat-damaged components or solder bridges.
- Unsolder the output pin of the 8V regulator and bend it up slightly to break contact with the PC board. If the voltage is still too low measured at the pin, replace the regulator.
- There are a number of places where you can easily break the 8V line to eliminate parts of the circuit in your search for the problem. One example is RFC16 on the RF board. If you lift one end of this inductor it will disconnect the entire synthesizer from the 8V line.
- A number of circuits have resistors in series with the 8V line, for example R112 in series with the I.F. amplifier (U12). If you measure voltage on both sides of these resistors you may find a circuit that is drawing high current or is shorted. Example: If you measured 7V on one side of R112 and 3V on the other, it would indicate that U12 had a current drain of 180 mA, which is much too high (I = E/R = 4/22 = 0.18).

060 No display on LCD

- If the bar-graph is also not working, check the 5V regulator (**052**)
- Remove the front panel hardware and panel from the front panel PC board and inspect the entire board for shorts or incorrect components. You may have LCD driver U1 in backwards or it may have a bent pin.
- Check the values of R15 and R16 on the bottom of the board; these resistors set the voltage for the LCD itself.
- Re-install the front panel board and turn on the K2. Using a voltmeter, measure the voltages on pins 16 and 17 of front panel connector J1 (ICLK and IDAT). These lines should show DC voltages between 0 and 5V due to data transmission from the microprocessor to the LCD driver. If the voltages are fixed at either 0 V or 5V rather than being somewhere in-between, the MCU may not be functioning (**075**)

065 Relay Problem

- If you suspect a ground short in any relay-controlled circuit (LPF, BPF, VCO) you can simplify debugging by pulling out the control board, then turning power ON and back OFF. This places all relays in the RESET condition (see schematic).
- If you hear no relays on power-up, check the IOC (**080**)

075 Possible MCU problem

- Measure the voltage on pin 32 of the MCU (U6, control board). If it is not 5V, check the 5V regulator (**052**).
- Remove the control board and carefully inspect the microprocessor. Make sure it is not installed backwards, has no bent pins, and is seated firmly in its socket.
- Verify that the MCU oscillator components all have the correct values and are soldered properly, with no shorts (X2, C21, C22).
- Listen for the 4-MHz oscillator signal using another ham-band receiver. If you can't hear the signal, try putting a 1M resistor across X2 on the control board. Also try rotating C22.

080 IOC Problem

- If you saw the message **INFO 080**, the I/O controller (IOC, RF-U1) or other auxBus device did not respond to messages from the main processor (MCU). Turn power OFF and back ON; if you hear some relays switching on power-up, the IOC may be OK, and the problem is likely to be with the AuxBus (**081**)
- If you do not hear any relays switching on power-up, your IOC (RF-U1) may be defective. Inspect U1 carefully to see if you have installed it backwards or if any pins are bent.
- Pull U1 out, check its pins, then re-install it, making sure all pins make good contact with the IC socket. Check the 4-MHz oscillator **(075).**
- Remove the bottom cover and verify that all pins of U1's socket are soldered, as well as those of the 6V regulator (RF-U2), and U1's 4 MHz oscillator (RF-Z5).
- With power ON, check all voltages associated with U1. You should see 6V at pins 1 and 20 at all times, even when the IOC is sleeping (not being accessed by the MCU).

081 AuxBus problem

- You may have an option board installed that is causing a problem with the AuxBus. Try removing each option board and turning power off and back on.
- Verify that R64 is installed (RF board, near U1).
- Check the voltage at pin 1 of the IOC (RF, U1). If it isn't approximately 6V, U2 may be bad (6V regulators).
- Check the voltage at pin 28 of the IOC (RF–U1). It should be between 5 and 6V. If it is zero volts, you probably have a short somewhere on the AuxBus line. Turn power OFF, then measure pin 28 of U1 to ground. If it is a short, pull the control board out to see if the short is on that board.
- If the voltage at pin 28 is between 5V and 6V, try pressing the **BAND+** button a number of times while watching the voltage carefully (use an oscilloscope if possible). The voltage should drop below 5V briefly if the MCU (CTRL-U6) is sending a message to the IOC. If the voltage does not change at all, the MCU itself may not be sending AuxBus messages.
- Check the AuxBus signal at the MCU, pin 40 (CTRL-U6). If you don't see this voltage drop below 5V briefly when the band is changed, the MCU may not be functioning (**075**).

090 EEPROM test #1 failed

091 EEPROM test #2 failed

- If you saw the message **INFO 090** or **INFO 091** on the LCD, one of the EEPROM write tests has failed.
- Check all voltages on the EEPROM (CTRL-U7).
- Remove the control board and inspect U7 and surrounding traces. Verify that U7 is properly soldered.

Receiver (100-149)

Problem	Troubleshooting Steps
100 Low (or no) audio output from receiver, or general receiver gain problem	▪ If you hear audio output on some bands but not all of them, check the band-pass and low-pass filters and T-R switch (**120**) ▪ Make sure you have headphones or speaker connected, and AF GAIN not at minimum ▪ Check for missing audio filter option (KDSP2 or KAF2) or their bypass jumpers ▪ Check the key jack for a short to ground ▪ Make sure RF GAIN is at maximum ▪ The AGC threshold control (R1, Control board) may be set incorrectly. Typical voltage at U2 pin 5 is 3.80 volts (no antenna, RF GAIN at max). You can set R1 for a slightly higher voltage at U2 pin 5 to increase the no-signal I.F. gain. If R1 is adjusted, you'll need to re-adjust CAL S HI and CAL S LO (S-meter). ▪ If you have the 160 m/RXANT option board installed, you may have menu entry **RANT** turned ON but no receive antenna connected; this may affect only one band since **RANT** can be set individually for each band. ▪ Peak the band-pass filters if you have not already done so ▪ Check for ground shorts in the LPF and BPF by first resetting all of the relays (**065**) ▪ Turn the AF GAIN to maximum ▪ If you don't hear any "hiss" at the receiver output, troubleshoot the AF amplifier (**110**) ▪ Check the 8V regulated supply voltage and troubleshoot if necessary (**053**) ▪ Measure the 8R line (+8V receive) at the anode of D6 on the RF board. It should be 8V +/- 0.5V. If not, look for a problem in the 8V switching circuitry (control board). ▪ Try using signal tracing (see procedure later in this section)
110 AF amp not working	▪ Use the menu to set a sidetone level of 60 (**ST L 060**). Hold **SPOT**. If you hear a strong tone, the A.F. amplifier itself is probably working; check the mute circuit (CTRL-Q6 and Q7) and trace the volume control lines back to the product detector (RF-U11) ▪ Remove the control board and inspect the entire A.F. amplifier and mute circuit for mis-installed components, shorts, and opens
114 AGC or S-meter not working	▪ If AGC appears to be working but the S-meter isn't, try re-calibrating the meter using **CAL S HI** and **CAL S LO**. If the S-meter is "stuck," you may have an open, short, or incorrect component in the area of U2 on the control board. ▪ Make sure the RF gain control is at maximum ▪ If the AGC and S-meter are both not working, you may have a dead 5.068 MHz oscillator crystal, X1 (control board). Listen for the 2nd harmonic of X1 at about 10.136 MHz while touching a screwdriver blade to pin 7 of U1 (NE602). If you can't hear this signal, try soldering a 22 k resistor from pin 7 to pin 3 on U1 (NE602).
120 Signal loss only on some bands	▪ If you have the 160 m/RXANT option installed, make sure you have menu entry **rANT** set to **OFF**, or if it is **ON** that you have a receive antenna connected ▪ If K60XV option connectors are installed (J13 and J15 on RF board), but the module is removed, install C6 and W6. ▪ Peak appropriate band-pass filters ▪ Inspect T-R switch components and voltages ▪ Trace signal from band-pass filters to the antenna using an RF signal generator ▪ Make sure the VCO is oscillating on affected bands by using the frequency counter

140 Receiver current drain is too high

- If you saw the message **INFO 140**, your receive-mode current drain was measured at over 500 mA during normal operation. Continue with the checks below.
- Use DISPLAY to show voltage and current on the LCD. If the current shown is > 300 mA with no incoming signal or > 200 mA with the bargraph turned OFF and no signal, you may have a short or excessive load on the 8V or 8R lines (**053**).
- You may have the speaker and/or external speaker jack wired incorrectly. This can place a short across the audio amp output, causing very low audio output (if any) and current as high as 500 to 800 mA.

Transmitter (150-199)

Problem — **Troubleshooting Steps**

150 General Transmitter problem

- If power output is too low, go to 155
- If power output slowly increases during key-down, go to 160
- If current drain on transmit is too high for the given power level or you see HI CUR, go to 175
- If the transmitter output power seems to be unstable go to 160
- If the transmitter stops transmitting by itself go to 170
- If the keyer isn't working properly, go to 180
- Use the signal tracing procedure

155 Power output is low or zero

- You may have CAL CUR (current limit) set too low; 2.00 A recommended at 10 W
- Check power output when using a 50Ω dummy load; if the output is correct on a dummy load but not when using an antenna, your antenna is probably not matched
- Install the bottom cover (all six screws) to prevent RF pick-up by low-level circuits
- Check all component values in the RF detector; you may have two resistors swapped (R67/R68, R66/R69) or the wrong detector diode (D9, should be 1N5711)
- You may have a short in the LPF or BPF; reset all of the relays before trying to look for shorts (**065**)
- Examine transformers T1-T4 carefully; these must be wound as indicated in part III of the RF board assembly section (see this section for drawings)
- Check all DC voltages in the transmitter (RF board, Q5/Q6/Q7/Q8) as well as the ALC circuitry (control board, U10A and RF board, Q24).
- One component that should be checked specifically is R50 (driver), which can open if the driver current goes too high.
- Make an RF probe and signal-trace through the transmitter to find where signal is lost (see probe and procedure later in this section)
- Check for any components getting hot
- Turn the K2 OFF and remove the heat sink; inspect all parts and check for shorts or opens

160 Power output fluctuates

- If you stay in key-down (TUNE) mode for several seconds, it is normal to see some increase in power; this is due to slow junction heating in the final amplifier transistors. It is not indicative of a problem unless current drain is too high for the given power output.
- If power goes up and down significantly during normal keying, you may have a poorly-matched antenna OR you may have power set too high for your battery or power supply to handle; try reducing power to see if it stabilizes
- If you have seen a slow (10-20Hz) oscillation superimposed on the transmitter's output signal, it could be due to ALC modulation. Increase the value of R98 (RF board) to the largest size that permits full output on 10 m.
- If the transmitter is truly unstable

	(oscillating) even when connected to a 50-Ω load, you may have an incorrect component value or a toroid-winding error; go through the checks at **155** ▪ Make sure none of the diodes in the T-R switch circuits are in backwards
170 Output power drops to zero suddenly	▪ If you have transmit power set too high for your battery or power supply, the supply voltage may drop so low on transmit that it resets the MCU (CTRL-U6) or the I/O controller (RF-U1). Reduce power.
175 Current drain too high on transmit (or **HI CUR** warning)	▪ You may have power set higher than the final amplifier can achieve, resulting in overdrive of all transmitter stages. Try reducing power to see if normal current drain is observed at lower power levels ▪ Damaged PA transistors or other components could cause inefficiency in any stage of the transmitter. Check all DC voltages and components; signal trace if necessarily (**155**)
180 Keyer Problem	▪ If the keyer is stuck at a fixed speed or the sidetone pitch won't change, go into the menu and see what sidetone pitch your have. If it's not in the range of 0.40-0.80 kHz, you may have bad data in the EEPROM. See "Resetting the Configuration to Defaults" in the Advanced Operating Features section. ▪ If the keyer is generally erratic when transmitting and seems to get worse as power is increased, you probably have RF leaking into the keyline. Try bypassing your key with .001 µF capacitors; also try 100 µH RF chokes in series with the paddle and ground connections. ▪ If your antenna is connected directly to the rig with no coax (i.e., internal ATU), the only way to cure RF problems with the keyer and other circuits may be to reduce transmit power, seek a better antenna match, or improve your ground system

Operation and Alignment (200-249)

Problem	Troubleshooting Steps
201 EEPROM initialized	▪ **INFO 201** is an informational message only, not a problem indication. You will see **INFO 201** one time on power-up. The only other time you might see this message is if you install a new version of the firmware that requires a reformat of EEPROM. (In most cases new firmware should not cause an EEPROM reformat, however.)
230 BFO not connected to frequency counter	▪ **INFO 230** is displayed if you try to use **CAL FIL** without the frequency counter connected to the BFO test point (RF-TP2)
231 VCO not connected to frequency counter	▪ **INFO 231** is displayed if you try to use **CAL PLL** without the frequency counter connected to the VCO test point (RF-TP1)
232 CAL PLL on wrong band	▪ **INFO 232** is most likely to be displayed if you use **CAL PLL** without first selecting 40 meters.
235 PLL ref. oscillator range error	▪ **INFO 235** is displayed if **CAL PLL** cannot complete VFO linearization due to inadequate PLL reference oscillator range (RF-Q19). ▪ You may have the frequency counter probe on the wrong test point (should be on TP1) ▪ Re-test the PLL reference oscillator using the procedure described under "PLL Reference Oscillator Test" in Part II of the RF board Alignment and Test section. ▪ If the PLL reference oscillator range is found to be inadequate, X1 may be defective. Also check D16, D17, C84, C85, and L31 for proper value.

Signal Tracing

Signal tracing is the primary method by which radio equipment is tested and repaired. You can solve nearly all receiver and transmitter problems yourself by following the steps in this section carefully.

RF Probe Assembly

Your K2 kit includes a complete RF probe, including the PC board, coax, and connectors. **The switch spacing tool, which you used in assembling the Front Panel, doubles as the PC board for the probe.** The RF probe (Figure 1) converts RF signals to DC so they can be measured using a DMM. The DC readings on your DMM will be approximately equal to the signal voltage in Vrms (root-mean-square).

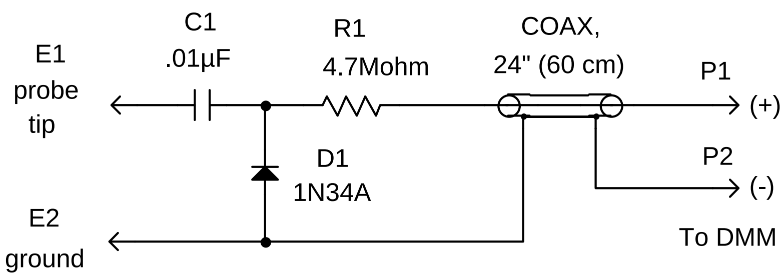


Figure 1

Assembly Instructions: Use a discarded lead from a large diode such as an SB530 or 95SQ015 as the probe tip (E1). It should be about 1" (2.5 cm) long. All other components for the probe can be found in the MISCELLANEOUS bag. An insulated alligator clip is provided for ground (E2). It should be connected to the board using 4" of black insulated hookup wire. Two banana plugs are supplied for connecting the probe to your DMM (P1-P2). Use RG174 coax between the probe board and the banana plugs. The coax should be secured to the board using one cable tie. Thread the cable tie through the two holes provided, near the coax end of the board.

To use the Probe: Connect E2 to the nearest ground test point, and plug the banana jacks into your DMM. Set the DMM for DC volts (20 or 30 V scale). Avoid touching the tip or discrete components while taking measurements.

Signal Generator

A simple crystal oscillator (Figure 2) can be used in lieu of a signal generator. This oscillator takes its output from the crystal itself, resulting in fairly low harmonic content. This results in very slight "pulling" of the oscillator frequency as you adjust the output level, but this is of no concern for signal tracing. The oscillator will run on voltages as low as 8 V, but 12 V or more is recommended to guarantee enough output for all signal tracing steps. The components are not critical, and can vary 20% with little variation in performance. Nearly any NPN RF transistor will work in the circuit.

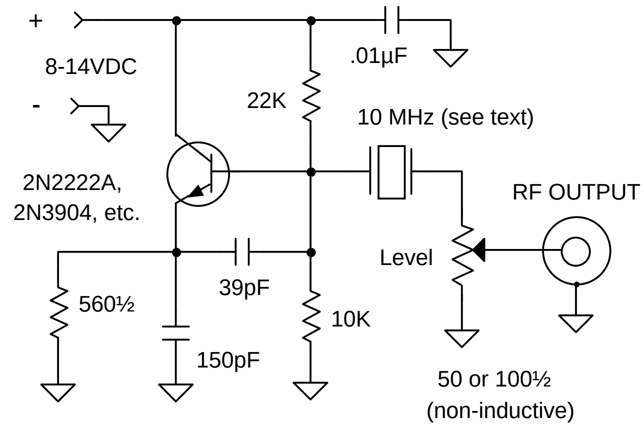


Figure 2

Any crystal frequency that falls in or near a ham band can be used, but 10 MHz is recommended since our signal tracing measurements were done using this band. If you have only completed the K2 up through part II of the RF board (40 m), you'll have to use a crystal in the 6.8 to 7.5 MHz range.

You may wish to build the oscillator into an enclosure fitted with a BNC connector and level control. Use short leads for all wiring. Use very short leads (2") or coax to connect the signal generator to the K2's antenna jack.

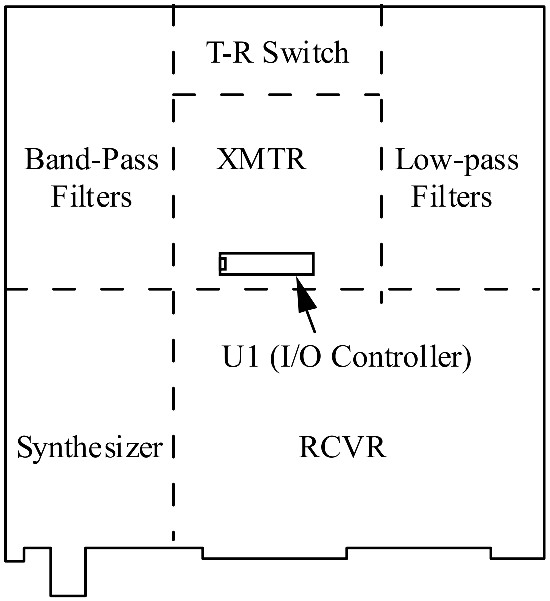


Figure 3

Receiver and Synthesizer

In the following steps you'll use the RF probe and other techniques to find the stage where the received signal is getting attenuated. (Figure 3 shows the approximate location of the synthesizer, receiver, and other circuits on the RF board.) You can then use voltage tables, resistance checks and close examination to find the bad component or connection.

Perform all measurements in the order listed. In general, your measurements can vary 20-25% from those shown and still be acceptable. Space is provided to record your own measurements (in pencil), which will be very useful if you need to re-test a particular circuit after repairs.

Preparation for Receiver Signal Tracing

1. Verify that basic display and control circuits are functioning.
2. Using your DMM, check the 5-V and 8-V regulator outputs.
3. Measure the voltages on the anodes (right end) of D6 and D7 (on the RF board, near the I/O controller, U1). In receive mode, D6's anode should be at about 8 V, and D7's should be near 0 V.
4. Connect the RF probe's output to your DMM's +/- DC input jacks.
5. Select a 2 or 3-V DC range.
6. The DMM should read close to 0.000 V DC. The reading should increase when you touch the RF probe tip with your finger.
7. Turn on the K2 and switch to 30 m (or the appropriate band for your signal generator). Select CW Normal mode.
8. Using the menu, select **OPT PERF.**
9. Use **CAL FIL** to set up CW normal filter FL1 for a bandwidth of **1.50**. If you can hear some noise on your receiver, set up the BFO for this filter as described in the Operation section of the manual. Otherwise, set the BFO to the factory default value.
10. Exit **CAL FIL**, then select the 1.50-bandwidth filter using **XFIL**.

PLL Reference Oscillator and VCO (RF board schematic, sheet 1)

1. Connect the RF probe's ground clip to the ground jumper near the synthesizer circuitry.
2. **Reference Oscillator Output:** Measure the reference oscillator signal at pin 1 of U4 (MC145170), which is near the front-left corner of the RF board (near the control board). Expected: 0.8-1.8 Vrms. Actual: ______.
3. **VCO Output:** Measure the VCO signal at pin 3 of U3 (LT1252). Expected: 0.30-0.40 Vrms. Actual: ______. If this signal is zero, you may have the secondary winding of T5 reversed.
4. **VCO Buffer Output:** Measure the signal on pin 6 of U3. Expected: 0.60-0.75Vrms. Actual: ______.
5. Check the VCO frequency (RF Board, Alignment and Test Part II).

BFO (RF, sheet 2)

1. **BFO Output:** Measure the signal on U11, pin 6 (NE602). Expected: 0.20-0.70 Vrms. Actual: ______.
2. Use the menu to select **CAL FCTR**. Press EDIT again to confirm; the display will now show a frequency reading (it will depend on where you have the frequency counter probe connected).
3. **BFO Buffer Output:** Measure the amplitude of the signal at TP2 using the RF probe. Expected: 0.025-0.070 Vrms. Actual: _______.
4. Exit **CAL FCTR**. Check the BFO frequency (RF Board, Alignment and Test Part II).

Low-Pass Filter, Bandpass Filter, and T-R Switch (RF, sheet 3)

1. Turn both the attenuator and preamp OFF using **PRE/ATT**.
2. Set RF GAIN to minimum.
3. Set AF GAIN to about 10% and connect a pair of headphones.
4. Switch to the 30 m (or the correct band for your signal generator).
5. Connect a signal generator or test oscillator to the antenna jack. Set the signal generator for 0.14 Vrms as indicated by the RF probe.
6. If possible, tune the VFO until you hear the signal. It may be quite strong even if your receiver is attenuating the signal somewhere. Find the approximate signal peak by ear. Set AF GAIN to minimum.
7. Align the band-pass filter for the current band if possible: (a) Put the RF probe on the banded end (cathode) of D6 (to the left of the I/O controller, U1); (b) adjust the band-pass filter for the current band for a peak indication on the DMM (on 30 m: adjust L8 and L9).
8. Aligning the band-pass filter may have changed the input impedance of the receiver. Put the RF probe back on the antenna input and adjust the signal generator for 0.14 Vrms again.
9. **Low-Pass Filter Output:** Measure the signal at jumper W1, near the PA transistors (Q7/Q8). Expected: 0.13 Vrms. Actual: _______.
10. **T-R Switch #1 Output:** Measure the signal at W6, which is just to the right of the transverter/60 meter option connector, J13 (near the back edge of the board). Expected: .093 Vrms. Actual: _______.
11. **Band-Pass Filter Output:** Measure the signal at the left side of D6. Expected: .086 Vrms. Actual: ______.
12. **T-R Switch #2 Output:** Measure the signal at the right side of D6. Expected: .077 Vrms. Actual: ______.

Mixer, I.F. Amplifiers, and Crystal Filter (sheet 2)

1. **Attenuator Off Test:** Measure the signal at the end of R72 closest to Q21. Expected: .077 Vrms. Actual: _____.
2. **Preamp Off Test:** Measure the signal at the end of R73 closest to Z6. Expected: .077 Vrms. Actual: _____. (Preamp gain will be tested later.)
3. **Composite Mixer Output:** Measure the signal at the right end of R80. Expected: .079 Vrms. Actual: _____.
4. **Post-Mixer Amp Output:** Measure the signal at the case (collector) of Q22 (2N5109). Expected: 2.20 Vrms. Actual: _____.
5. **-5 dB Pad Output:** Measure the signal at jumper W2, near the crystal filter. Expected: 1.40 Vrms. Actual: _____.
6. **Crystal Filter Output:** Touch the RF probe to jumper W3, near the crystal filter. Adjust the VFO for a peak in the DMM reading. Expected: 0.35 Vrms. Actual: _____. If this reading is low, it may be due to a non-optimal setting of the BFO in CAL FIL. Try a different BFO setting, then adjust the VFO for peak again and re-measure the filter loss. (Note: this measurement exaggerates the filter loss because the *input* to the filter is a composite of many signals besides the desired one.)
7. **T7 Step-Up Ratio:** Measure the signal at U12, pin 4 (MC1350). Expected: 0.4-0.8 Vrms. Actual: _____. **Note:** Limited by D40-D41.
8. **I.F. Amp Saturated Output:** Measure the signal at U12, pin 8. It may be anywhere between 0.00 and 0.30 Vrms. Adjust the signal generator level until the DMM reads approx. 0.15 Vrms. (If your signal generator is running from a 9-V battery you may have trouble getting the output this high. Try running the generator from 12V or more in this case.)
9. **2nd Crystal Filter Output:** Measure the signal at U11, pin 1 (NE602). Expected: approx. 0.27 Vrms. Actual: _____.
10. **Product Detector Saturated Output:** Measure the signal at U11, pin 5 (NE602). Expected: 0.58 Vrms. Actual: _____.

AGC (Control Board)

1. Disconnect the RF probe from the DMM. Connect the DMM's (-) lead to chassis ground.
2. Turn the signal generator completely OFF (remove its power).
3. Set RF GAIN to maximum.
4. **No-Signal AGC, Max. IF Gain:** Measure the DC voltage on pin 1 of U2 (LM833). Expected: 3.6 V. Actual: _____.
5. Set RF GAIN to minimum.

6. **No-Signal AGC, Min. IF Gain:** Measure the DC voltage on pin 1 of U2. Expected: 4.6 V. Actual: _____.
7. Turn the signal generator back on.
8. **AGC @ Saturation:** Measure the DC voltage on pin 1 of U2. Expected: 6.9 V. Actual: _____. Adjust the VFO to make sure this voltage is at its peak.
9. **I.F. Amp AGC Input:** Measure the DC voltage on pin 5 of U12 (RF, sheet 2). Expected: 5.0 V. Actual: _____.

Product Detector and AF Amp (RF, Sheet 2)

1. Set up the DMM to read AC volts (use a 2 or 3-V meter range).
2. Touch the (+) lead of the DMM to pin 5 of U11 (NE602). Decrease the signal generator level until the AC voltage at pin 5 reads .025 Vrms. (The K2's RF GAIN control should still be at minimum.)
3. Disconnect the headphones and speaker. Turn the AF GAIN control to maximum.
4. Measure the signal at the speaker jack, P5 pin 1 (near the on/off switch, S1). Expected: 1.6 Vrms. Actual: _____.

I.F. Amp Noise Gain (RF, sheet 2)

1. Turn the signal generator off and disconnect it from the antenna jack. Connect a 50-ohm dummy load.
2. Turn off all nearby equipment (especially computers or signal sources).
3. Set AF GAIN to maximum. Set RF GAIN to minimum.
4. Make sure the preamp and attenuator are both OFF.
5. Verify that FL1 is selected (bandwidth = 1.50), as well as CW Normal mode.
6. **AF Output, Min. IF gain:** Setup the DMM for its lowest AC volts range. Measure the signal at the speaker jack, P5 (near the on/off switch, S1). Expected: 0.000-0.001 Vrms. Actual: _____.
7. **AF Output, Max. IF gain:** Set RF GAIN to maximum. Measure the signal at P5, pin 1. Expected: 0.007-0.013 Vrms. Actual: _____.
8. **Preamp Noise Gain:** Turn on the preamp. Measure the signal at P5. Expected: 0.030-0.060 Vrms. Actual: _____.
9. **Noise Increase w/Antenna:** Connect an antenna. The signal at P5 should increase substantially even if atmospheric conditions are quiet. A typical reading on 30 or 40 m is 0.20-0.40 Vrms. In general, the longer or higher your antenna is, the greater the noise increase will be.

Final Steps

If you have completed receiver signal tracing and any necessary repairs, you should then do the following:

1. Re-install the bottom cover and heat sink.
2. Re-do calibration of the VCO, BFO, band-pass filters, crystal filters, etc. as needed (see RF Board Alignment and Test, parts I, II, and III). If you peaked L8 and L9 when signal tracing through the 30-m band-pass filter, you'll need to re-peak C21 and C23 on 20 m.
3. Leave the frequency counter cable connected to TP2 (BFO)
4. Connect the speaker and re-install the top cover.

Transmitter

The following procedure can be used to isolate problems with the transmitter (the transmitter area of the RF board is identified in Figure 3). CW mode is used for these tests. If you're having difficulty with the SSB adapter, make sure the transmitter works on CW first, then proceed with the signal tracing instructions in the SSB adapter manual.

Once you find a location where the signal appears to be much lower than expected, stop signal tracing and check that circuit. Check all component values and DC voltages (see DC Voltage Tables). Closely examine the PC board for unsoldered pins and solder bridges. One of most likely causes of a transmitter problem is a poorly-soldered toroid lead. Re-heat any suspect leads or solder joints.

Preparation for Transmitter Signal Tracing

1. Make sure basic display and control circuits are functioning before attempting transmitter testing.
2. Remove the SSB adapter (if installed) and install temporary jumpers at J9 and J10. Temporarily re-install C167 (.001 µF or higher) between pins 7 and 12 of J11. (See RF board, sheet 2.)
3. **12 V supply check:** Use your DMM to check the DC voltage at the cathode (banded end) of D10 (right edge of the board). Expected: 9 to 14 V. Actual: _____. Verify that the same voltage (or slightly lower) can be found on the case (collector) of Q5 and the tab (collector) of Q6 when the K2 is turned on and is in receive mode.

4. If you don't have an RF probe, you can build the one from Figure 1. **Note:** do not use the RF probe to directly measure the transmitter's power output unless you have the power set for 2 W or less. The 1N34A diode in the RF probe may be damaged at higher power levels.
5. **Test Shared Circuits:** Do the *receiver* signal tracing (above). This tests a number of circuits that are shared by both transmitter and receiver, including the VCO, BFO, BFO buffer, T-R switches, band-pass filters, and low-pass filters. **It's important not to skip this step,** even if the receiver seems to be working correctly. Shared circuits that are working marginally may affect the transmitter more than the receiver, so their actual output levels must be measured.
6. Set up the K2 for 40 meters (about 7100 kHz), CW Normal mode.
7. Plug in a 50-ohm dummy load (10-W or higher rating).
8. Set the power level to 5 watts.
9. Connect a hand key or keyer paddle to the key jack.
10. Connect a speaker or headphones.
11. Use the menu to set **ST L** 030, **ST P** 0.50, and **T-R** 0.05.
12. Select hand key mode (**INP HAND**).
13. Set up a transmit current limit of 2.50 amps using **CAL CUR**.

Basic voltage checks (RF schematic, sheet 2)

Note: When using **TUNE** to key the transmitter, be sure to tap **TUNE** again within 5 seconds or less each time. This will reduce the chance of damaging any components in the transmitter that are consuming excess power.

1. Switch to voltage/current display mode using **DISPLAY**.
2. Hold **TUNE** to key the transmitter, and verify that supply voltage does not drop by more than about 0.8 V. If it drops more than this, either your power supply is inadequate or the transmitter is drawing excess current. Actual transmit-mode voltage: _____ V. Current: _____ A.
3. Return to normal display mode using **DISPLAY**.
4. Measure the key-down DC voltages on the anodes (right end) of D6 and D7 (near U1, the I/O controller). During transmit, the voltage on the anode of D7 should be about 8 V, and on D6, near 0 V. Actual TX-mode voltages, D6: _____ V; D7: _____ V.
5. Use **TUNE** and note the actual power output: _____ W.

Sidetone (Control Board)

Note: If the sidetone is already functioning correctly, you can skip this section.

1. Make sure you're in CW mode. The sidetone will not function in SSB modes.
2. Disconnect the headphones and speaker.
3. Use the menu to set **ST L** to 255 (maximum sidetone level).
4. Use the **VOX** button to select CW TEST mode (the mode letter will then flash). This is a safe setting for sidetone tests, since there is no power output.
5. Set your DMM for AC volts, 2 or 3-V range. Touch the positive lead of the DMM to pin 4 of U8 on the control board (18C452). (This is the source of the sidetone signal.)
6. Key the transmitter using the hand key (**TUNE** does not activate the sidetone). Measure the AC voltage on pin 4 of U8. Expected: 2.5 Vrms. Actual: _____. Un-key the transmitter.
7. Move the DMM probe to the drain of Q5 (control board, 2N7000). Key the transmitter and measure the AC drain voltage. Expected: 2.4 Vrms. Actual: _____. If this is zero, either Q5 is defective or there is no drain voltage supply from pin 1 of U8 (MAX534, D-to-A converter).
8. Measure the AC voltage on pin 7 of U10 (LMC660). Expected: 0.5 Vrms. Actual: _____.
9. Measure the AC voltage on pin 8 of U9 (LM380). Expected: 0.5 Vrms. Actual: _____.
10. Measure the AC voltage on pin 6 of U9. Expected: 0.5 Vrms. Actual: _____. This signal should also be present on the speaker jack, P5 pin 1 (RF board).
11. Return the **ST L** setting to 030.
12. Use the **VOX** button to put the transmitter back into **OPERate** mode.

ALC (control board)

1. Make sure the POWER control is set for 5 watts, and that you're in CW/Operate mode.
2. Set up the DMM for DC volts, 20 or 30-V range.
3. **Power Control Test (VPWR line):** The VPWR line, pin 2 of U8 (MAX534), is where transmit power control begins. On key-down, the microprocessor (U6) starts increasing the voltage on VPWR until it sees the desired power indication from the RF output detector (RF board,

sheet 3, lower right-hand corner). To test VPWR, set the DMM for DC volts, then measure the DC voltage on pin 2 of U8 when **TUNE** is pressed. Expected: 0.7-2.5 VDC. Actual: _____.

4. **If VPWR reading is high (> 4.5 V):** The ALC software will set VPWR to its highest level (about 5 V) if the transmitter cannot be driven to the requested power level. This happens for one of two reasons: (a) the transmitter gain is low (or transmitter isn't working at all); (b) the RF detector has an incorrect component. Check all component values in the RF detector. If you can't find a problem with the RF detector, continue with the next signal tracing section (transmit mixer, etc.).
5. **If VPWR reading is low (< 0.4V):** VPWR can be too low because: (a) the ALC software is being "fooled" by a signal from the RF detector that says the power is higher than it really is; (b) because U8 on the control board is defective or has a pin shorted to ground or not soldered. Check all component values in the RF detector (RF, sheet 3). If these appear correct, check DC voltages on U8 (control), as well as resistance to ground on all pins.

Transmit Mixer, Buffer, Band-Pass Filter, T-R Switch (RF, sheets 2-3)

Note: The measurements in this section and the next may vary widely, especially if you do the measurements on a band other than 40 m. However, the *ratio* between any two back-to-back measurements should remain fairly constant, and is a good indication of gain or loss of a stage in the transmitter. For example, the ratio of measurements in steps 3 and 2 below is about 12.

1. Connect the RF probe to the DMM. Set the DMM for a 2 or 3-V DC volts range.
2. **Xmit Mixer Output:** Measure the key-down signal at U10, pin 4. Expected: 0.016 Vrms. Actual: _____.
3. **Buffer Output:** Measure the key-down signal at U9, pin 6 (LT1252). Expected: 0.200 Vrms. Actual: _____.
4. **Band-Pass Filter Output:** Measure the key-down signal at W6. Expected: 0.030 Vrms. Actual: _____.
5. **T-R Switch #1 Output:** Measure the key-down signal at the anode of D1. Expected: 0.029 Vrms. Actual: _____.

Pre-driver, Driver, and PA (RF, sheet 4)

1. **Pre-Driver Output:** Measure the key-down signal at the case (collector) of Q5 (2N5109). Expected: 0.120 Vrms. Actual: _____.
2. **Driver Input:** Measure the key-down signal on the base of Q6 (2SC5739 or 2SC2166; pins are labeled *B*, *C*, *E*). Expected: 0.026 Vrms. Actual: _____.
3. **Driver Output:** Measure the key-down signal at the tab (collector) of Q6. Expected: 1.8 Vrms. Actual: _____.
4. **PA Input (Q7):** Measure the key-down signal at the base of Q7 (2SC1969 on bottom of the board; pins are labeled on the top). Expected: 0.38 Vrms. Actual: _____.
5. **PA Input (Q8):** Measure the key-down signal at the base of Q8. Expected: 0.38 Vrms. Actual: _____.
6. **RF Detector Input:** Measure the key-down signal on the anode (non-banded end) of D9 (1N5711, middle of the right edge of the board). Expected: 2.0 Vrms. Actual: _____. (This voltage should be fairly constant regardless of the band used.)
7. **PA Transistor Tests:** If the PA input voltages were higher than expected, but the RF detector input was too low, one or both PA transistors could be defective. After checking DC voltages and transformer leads, turn off power to the K2 and use your DMM's diode/transistor test range to test the transistors. With the DMM's positive lead on the base of Q7, you should measure about 0.6 k to the emitter or collector. With the DMM's negative lead on the base of Q7, you should measure about 1.3 k to the emitter and > 3 k to the collector. These also apply to Q8.

DC Voltage Tables

The tables on the following pages provide DC voltages for all ICs and transistors on each of the three boards, as well as the diodes in the T-R switch (RF board). Typically, your readings will match these within 10%.The voltages were measured using a high-impedance DMM (10-11 Megohm). The K2's internal voltmeter can also be used for most measurements.

Receive-mode voltages are listed except as noted. Most of the Control board measurements were made with the Front Panel module removed for easier access. Exceptions are indicated by (**).

Equipment Setup: Supply voltage 14.0 V; no antenna; LCD = NITE; GRPH = DOT; receive mode; no headphones or speaker connected; RF GAIN mid-range; AF GAIN minimum; OFFSET mid-range.

CONTROL BOARD (Front panel removed except ** = CAL FCTR mode w/front Panel plugged in; * = approximate and/or may fluctuate)

Ref.	**Pin**	**VDC**	**Ref.**	**Pin**	**VDC**	**Ref.**	**Pin**	**VDC**	**Ref.**	**Pin**	**VDC**	**Ref.**	**Pin**	**VDC**	**Ref.**	**Pin**	**VDC**
Q1	E	8.0	Q12	E	6.3	U6	1	5.0	U6	34	0.0	U9	1	0.4*			
	B	8.0		B	7.0		2	0.0*		35	0.2*		2	.02*			
	C	0.0		C	8.0		3	5.0*		36	0.8*		3	.02*			
Q2	E	8.0	U1	1	1.4		4	0.2*		37	5.0		4	0.0			
	B	7.3		2	1.4		5	2.6*		38	1.2*		5	0.0			
	C	7.5		3	0.0		6	4.7*		39	0.2*		6	6.7			
Q3	S	0.0		4	6.9		7	0-5*		40	5.5		7	13.7			
	G	0.0		5	6.9		8	0-5*	U7	1	5.0		8	6.8			
	D	8.0		6	8.0		9	0 or 5		2	5.0	U10	1	7.7*			
Q4	S	0.0		7	7.5		10	5.0**		3	5.0		2	5.0*			
	G	5.0		8	8.0		11	5.0		4	0.0		3	5.0*			
	D	0.0	U2	1	6.9		12	0.0		5	5.0		4	8.0			
Q5	S	0.0		2	6.9		13	2.3*		6	0.0		5	5.0			
	G	0 or 5		3	6.9		14	2.4*		7	5.0		6	5.0			
	D	0-5		4	0.0		15	2**		8	5.0		7	5.0			
Q6	G	2.7*		5	7.3		16	0-5*	U8	1	0-5*		8	0-8*			
	S	5-6*		6	7.3		17	2.7*		2	5.0**		9	0-8*			
	D	5-6*		7	7.3		18	0.0		3	5.0		10	0-8*			
Q7	G	2.7*		8	8.0		19	5.0		4	0.0		11	0.0			
	S	5-6*	U3	1	0.4*		20	5.0		5	0.0		12	0-8*			
	D	5-6*		2	13.7		21	5.0		6	5.0		13	0-8*			
Q8	E	7.0**		3	13.7		22	5.0		7	5.0		14	0-8			
	B	7.7**		4	0.0		23	5.0		8	0 or 5						
	C	8.0**		5	2.5		24	5.0		9	5.0						
Q9	E	0.0		6	2.5		25	0.0		10	0.0						
	B	0.7**		7	2.5		26	5.0		11	5.0						
	C	2 **		8	13.7		27	0.0		12	0.0						
Q10	E	0.0	U4	IN	13.7		28	5.0		13	5.0						
	B	0.7**		GND	0.0		29	5.0		14	0.0						
	C	2**		OUT	8.0		30	5.0		15	0-5*						
Q11	E	0.2*	U5	IN	13.7		31	0.0		16	0-5*						
	B	0.9*		GND	0.0		32	5.0									
	C	13.5		OUT	5.0		33	5.0									

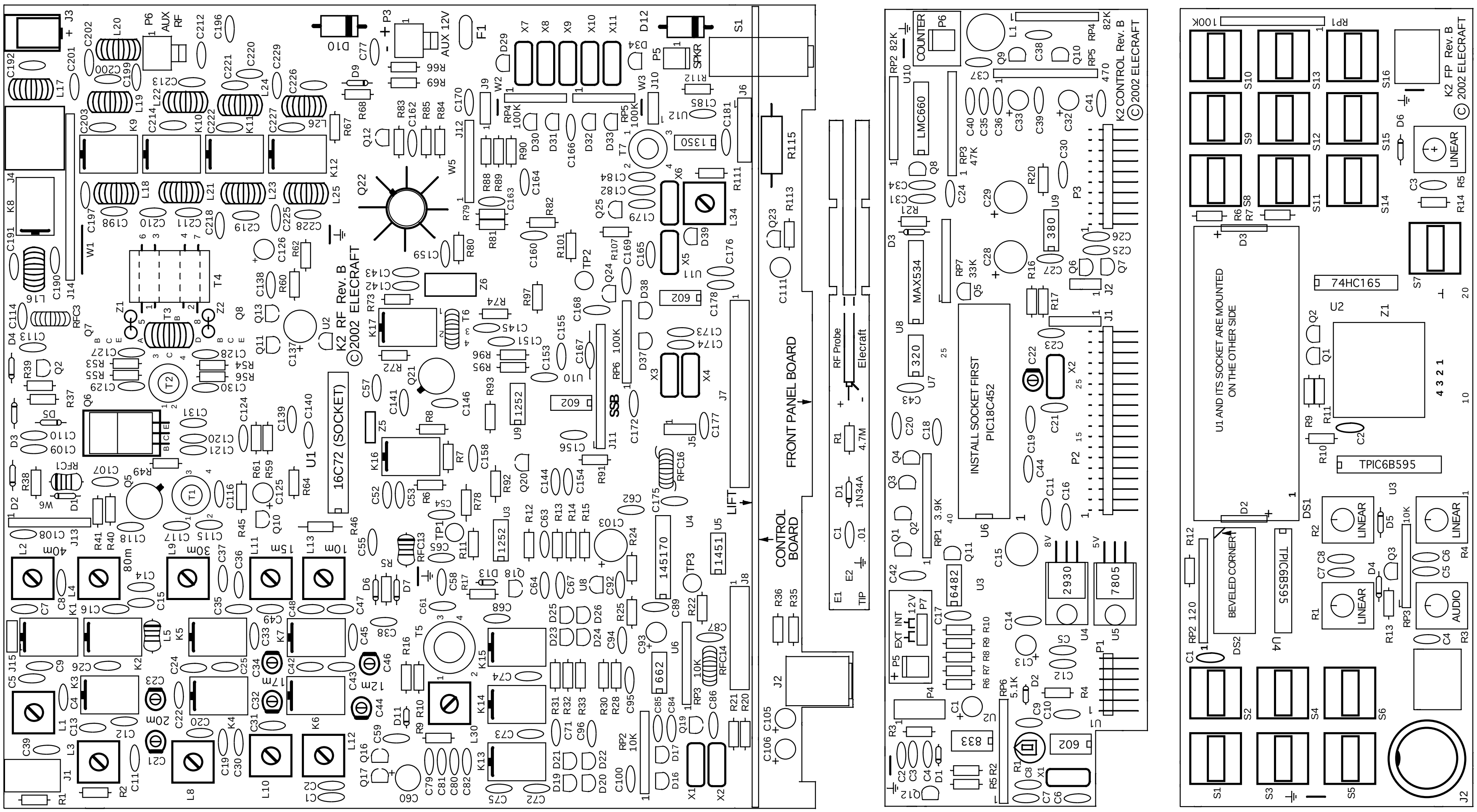
FRONT-PANEL BOARD (* = approximate and/or may fluctuate; ** = not accessible due to LCD)

Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC
Q1	E	2.7	U1	26	3.5	U3	1	0.0	U4	15	0.0						
	B	3.4		27	3.5		2	5.0		16	0.0						
	C	5.0		28	3.5		3	0.8*		17	0.0						
Q2	E	2.7		29	3.5		4	> 0		18	0.4*						
	B	3.4		30	3.5		5	> 0		19	0.0						
	C	5.0		31	3.5		6	4.0*		20	0.0						
				32	3.5		7	2.0*									
				33	3.5		8	5.0									
				34	3.5		9	0.0									
U1	1	**		35	3.5		10	0.0									
	2	**		36	3.5		11	0.0									
	3	**		37	3.5		12	.02*									
	4	**		38	3.5		13	0.2*									
	5	**		39	3.5		14	3.1*									
	6	**		40	3.5		15	0.8*									
	7	**	U2	1	5.0		16	4.0*									
	8	**		2	0.2*		17	0.1									
	9	**		3	5.0		18	3.6*									
	10	**		4	5.0		19	0.0									
	11	**		5	5.0		20	0.0									
	12	**		6	5.0	U4	1	0.0									
	13	**		7	5.0		2	5.0									
	14	**		8	0.0		3	3.6*									
	15	**		9	0.1*		4	> 0									
	16	**		10	0.0		5	> 0									
	17	**		11	5.0		6	> 0									
	18	**		12	5.0		7	> 0									
	19	**		13	5.0		8	5.0									
	20	**		14	5.0		9	0.0									
	21	3.5		15	0.0		10	0.0									
	22	3.5		16	5.0		11	0.0									
	23	3.5					12	.02*									
	24	3.5					13	0.2*									
	25	3.5					14	0.0									

RF BOARD (Shaded areas indicate transmit-mode voltage measurements)

Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC	Ref.	Pin	VDC
D1	A	0.0	Q12	S	0.0	U1	1	6.0	U3	6	4.3	U8	IN	8.0			
	C	7.5		G	6.0		2	6.0		7	8.0		GND	0.0			
D2	A	8.0		D	0.0		3	0.0		8	0.0		OUT	5.0			
	C	7.5	Q13	E	0.6		4	0.0	U4	1	2.1	U9	1	0.0			
D3	A	8.0		B	1.3		5	0.0		2	2.4		2	6.9			
	C	7.5		C	7.5		6	0.0		3	0.0		3	6.9			
D4	A	8.0	Q16	E	0.0		7	0.0		4	2.3		4	0.0			
	C	7.5		B	0.6		8	0.0		5	5.0		5	0.0			
D5	A	0.0		C	2.2		9	0.2		6	5.0		6	6.9			
	C	8.0	Q17	S	0.0		10	0.15		7	0.0		7	13.8			
D6	A	8.0		G	2.2		11	0.0		8	0.1		8	0.0			
	C	7.5		D	2 to 3		12	0.0		9	0.0	U10	1	1.4			
D7	A	0.0	Q18	G	-1.0		13	0.0		10	0.0		2	1.4			
	C	7.5		S	2 to 3		14	0.0		11	0.0		3	0.0			
Q2	S	0.0		D	6.3		15	0.0		12	0.0		4	5.0			
	G	8.0	Q19	G	0.0		16	0.0		13	4.0		5	5.0			
	D	0.0		S	0.8		17	0.0		14	5.0		6	6.0			
Q5	E	0.6		D	8.0		18	6.0		15	5.0		7	5.5			
	B	1.3	Q20	S	0.0		19	0.0		16	5.0		8	6.1			
	C	12.4		G	8.0		20	6.0	U5	1	0.0	U11	1	1.4			
Q6	B	1.1		D	0.0		21	0.0		2	5.0		2	1.4			
	C	13.3	Q21	E	1.6		22	0.0		3	5.0		3	0.0			
	E	0.4		B	2.3		23	0.0		4	5.0		4	5.0			
Q7	B	0.6		C	13.2		24	0.0		5	0.0		5	5.0			
	C	13.4	Q22	E	1.3		25	0.0		6	2.0		6	6.1			
	E	0.0		B	2.0		26	0.0		7	0 to 4		7	5.6			
Q8	B	0.6		C	12.5		27	0.0		8	5.0		8	6.1			
	C	13.4	Q23	S	0.0		28	5.5	U6	1	0 to 8	U12	1	7.9			
	E	0.0		G	0.0	U2	IN	13.7		2	0 to 4		2	7.9			
Q10	S	1.6		D	8.0		GND	0.0		3	0 to 4		3	0.0			
	G	8.1	Q24	G	0.0		OUT	6.0		4	0.0		4	2.5			
	D	1.6		S	1.2	U3	1	0.0		5	4.0		5	3.9			
Q11	E	0.0		D	1.3		2	4.3		6	4.0		6	2.5			
	B	0.6					3	4.1		7	0 to 8		7	0.0			
	C	1.3					4	0.0		8	8.0		8	7.9			
							5	0.0									

Appendix F Parts Placement Drawing, Top



Appendix F Parts Placement Drawing, Bottom

